The Heating and Ventilating Magazine

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MARCH, 1925

Don'ts on Theatre Ventilation

What To Look Out For In Arranging The Air Supply For Such Buildings, Based Upon Designing Experience and Tests of Installation in 608 Theatres

By E. Vernon Hill

POSING as an expert is a dangerous business in any field of human endeavor. This is particularly true with a subject like theatre ventilation where the number of variables in the problem make results always more or less of a gamble, and where success depends so largely on the skill, intelligence and experience of the person or persons who operate the system. We disclaim, therefore, any intention of writing as an expert on this subject where results a r e a l w a y s doubtful, even in the simplest installations, and which are becoming more intricate and problematic with the recent wide adoption of mechanical refrigeration in theatre cooling work. In fact, we should hesitate to write upon the subject at all with our few years of experience in designing, heating, ventilating and refrigerating apparatus in perhaps a dozen theatres, were it not for the background of a dozen years' experience in the approval of plans and the testing of installations in 608 theatres in Chicago during the writer's service in the Ventilating Division of the City Health Department.

It was during this time that the present practice in theatre ventilation was developed in Chicago, and it was in this city that the earliest refrigerating installations were made. The Riviera Theatre was the first, a daring experiment. The calculated tonnage was out of all proportion to commercial practicability as viewed at the time. Methods of introduction, the question of recirculation, compliance with existing ordinances, were subjects of numerous conferences in the writer's office. Somewhat radical concessions were made as to the amount of air handled, the proportion of recirculated air allowed, etc., for practical and financial reasons, and with the expectation of materially improving air conditions during the hot summer months and promoting thereby the health and comfort of theatre patrons.

In testing the installation after its comple-

Don'ts For Theatre Ventilation

1. Don't use the mushroom system of supply for cold air.
2. Don't pass all air through the cooler.
3. Don't omit complete mechanical exhaust with refrigerating systems.
4. Don't omit automatic temperature control with refrigerating systems.
5. Don't supply cold air at low points and expect to pull it up with the exhaust.
6. Don't supply warm air at high points and expect to pull it down with exhaust.
7. Don't expect to pull air any place. You can push, but you cannot pull.
8. Don't conceive of a theatre as a tight box. It never is.
9. Don't introduce air into a theatre auditorium from the rear unless you know exactly where it is going and can accurately control its temperature and velocity.
10. Don't expect a thermostat on the main floor to maintain conditions of comfort in the balcony, or vice-versa.
11. Don't supply air to the main floor and balcony, or to the main floor and dressing rooms with the same fan.
12. Don't expect air currents to follow trained arrows on the plans, unless you are sure the arrows are thoroughly and properly trained.
13. Don't expect a Rolls-Royce ventilating system at the cost of a Ford.

tion, we learned much that aided us in advising regarding the design of others that followed, and our constant checking of the operation of these and subsequent theatres that were equipped with cooling apparatus, resulted in a considerable amount of experimental data that could not be duplicated in any other city in the United States, and probably in the world. This is the excuse, therefore, in writing the following "Don'ts" on theatre ventilation which may be of value to engineers who are called upon to design theatre ventilating and refrigerating apparatus and who have not had actual experience with the operation of such plans:

1. *Don't Use The Mushroom System of Supply for Cold Air.*—In cooling a theatre in hot weather, the air must be introduced at approximately 10° below the temperature it is desired to maintain in the occupied zone. This is necessary to absorb the heat from the occupants, heat infiltration, lights, etc. Air introduced through mushrooms, around the feet of theatre patrons, 10° below the temperature it is desired maintained, is very uncomfortable. It should be introduced from the side walls preferably, from the ceiling if side wall supply cannot be utilized. In this way the entering cold air is mixed and diffused with the warm air before reaching the occupied zone, and much better results obtained. Where cooling is employed exhaust should be near the floor line or through mushrooms in the floor.

2. *Don't Pass All Air Through The Cooler.*—In refrigerating air for theatre cooling, a common mistake is to pass all of the air delivered to the theatre through the cooler. To obtain the desired cooling effect, it is necessary usually to reduce the temperature of the air below the dew-point. If it is all passed through the cooler, it is introduced into the theatre in a saturated condition which makes it clammy and uncomfortable, maintains the humidity at an unnecessarily high percentage, interfering with the tuning of stringed instruments in the orchestra, and damaging decorations and other appurtenances in the theatre. If a considerable portion, approximately one-half of the air, by-passes the cooler and is mixed with the refrigerated air before being introduced, the results will be much better and an equal or greater cooling effect will be obtained with the same tonnage.

3. *Don't Omit Complete Mechanical Exhaust With Refrigerating Systems.*—Refrigerated air is heavier than the air in the auditorium, due to its relatively low temperature. It mixes with the warm air sluggishly, especially if introduced at low velocities. It tends to hug the floor and to flow like water to the low points, at the front of the theatre, orchestra pit, etc. It should be introduced with care at well-located points, and its flow controlled by an ample exhaust. In some instances the exhaust capacity must exceed the supply.

4. *Don't Omit Automatic Temperature Control With Refrigerating Systems.*—Theatre cooling without temperature control, whereby the volume of air by-passing the cooler is regulated in accordance with the temperature desired, is a dangerous practice. Temperature control is desirable in any ventilating equipment, but it is essential where refrigeration is employed.

5. *Don't Supply Cold Air at Low Points and Expect to Pull It Up With The Exhaust.*—This warning should be considered carefully in connection with No. 3 and also with No. 8. While ample exhaust is essential in a refrigerated theatre, do not expect too much of it. We recall an instance where cold air was supplied near the orchestra pit in a Chicago theatre with exhaust from the rear under the balcony, with the expectation of pulling the cold air upward through the auditorium by means of the exhaust. The results were the direct opposite. The cold air introduced at the low point stayed in this location, and the exhaust underneath the balcony pulled the hot air in from the lobby and from out-of-doors, making a difference of 12° between the temperature in the orchestra pit and the space beneath the balcony.

6. *Don't Supply Warm Air at High Points and Expect to Pull It Down With Exhaust.*—This may be considered as a corollary of No. 5. Cold air being heavier than the air in the auditorium, has a strong tendency to stay at the floor-line if introduced at this point. Warm air, if introduced high up on the side walls or through the ceiling, has a strong tendency to stay at this point as it is lighter than the air in the auditorium. The ideal method is a reversible system, which, introduces warm air during the heating season through mushrooms in the floor, exhausting through side-wall registers. In warm weather when the refrigerating apparatus is in use, the system is reversed; the cool air is introduced through side walls and exhausted through the mushrooms in the floor.

7. *Don't Expect To Pull Air Any Place. You Can Push But You Cannot Pull.*

8. *Don't Conceive of a Theatre as a Tight Box. It Never Is.*—In laying out a ventilating system, the designer frequently falls into the error of conceiving of a theatre as a tight box. He sometimes thinks, for example, that if he introduces warm air at the ceiling, with ample exhaust at the floor line, the warm air will come down and pass out of the exhaust openings, having no other place to go. As a matter of fact, warm air introduced through the ceiling will form a hot blanket at the top of a theatre, descending as its volume increases, until it reaches the proscenium arch, the upper part of exit doors and other openings where it escapes. The exhaust at the floor line will favor the entrance of cold air at low points, creating objectionable drafts and making heating difficult.

9. *Don't Introduce Air Into a Theatre Auditorium From The Rear Unless You Know Exactly Where It Is Going and Can Accurately Control Its Temperature and Velocity.*—Experience has amply demonstrated the fact that a certain volume of air at a certain temperature and velocity may be comfortable and pleasant if it strikes the occupants horizontally in the face. The same temperature and velocity from the rear may be decidedly disagreeable. Furthermore, there is a much wider variation in the susceptibility of different individuals to drafts

(*Continued on Page* 53)

New Application of Old Principles in Heating An Apartment Building

Details of One-Pipe Gravity-Return System and Air Supply Equipment for the Hibbard Apartments, Detroit, Mich.

A NOVEL and somewhat new application of old principles has been utilized in designing the heating and ventilating system for the new Hibbard Apartments, recently completed in Detroit. The building is isolated on four sides, subject to high winds from the lake and river and has 43 large apartments on nine floors, the first floor being allotted to two stores, office of the building, laundry, boiler room and storage room. The tenth floor walls are set back from the main building providing three apartments. There is only a small basement under one of the stores for storage, the boiler room being only 30 in. below the level of the main floor at the rear of the building.

DESIGN OF ONE-PIPE GRAVITY RETURN SYSTEM

The heating system is a one-pipe gravity return system, served by a 10 in. main overhead distributing system and two American Radiator Company Type "T" boilers, rated at 9,000 sq. ft. each. There is a total of 10,000 sq. ft. of direct radiation, and 900 sq. ft. of indirect pipe coils in the pent house for supplying fresh air to the building at 70° F. All living and dining rooms have two radiator units so that regulation may be obtained by shutting off one or both radiators to suit the weather conditions.

The main runs direct to the roof space under the tenth floor, with 23 single-pipe drop risers, with single-pipe connections to the radiators. Dunham traps are provided at the base of each riser only for passing air and condensation to two dry returns on either side of building. All radiators above the ground floor are provided with Hoffman No. 2 vacuum air valves to exclude air from the radiation and system when cold. These air valves function in the regular way when more than 1-lb. pressure is on the system, releasing the air to the room. When the pressure in the radiator is below atmosphere they are designed to close and prevent air from entering the system. The job operates satisfactorily—below atmospheric pressure most of the time.

Radiation is indicated on the floor plans (Figs. 1 and 2). The ground-floor radiators are placed on the side walls 5 ft. 6 in. from the floor and connected to a separate wet return under the floor and below the water-line of the boiler. This brings the radiators about 2 ft. 6 in. above the water-line of the boilers.

Fig. 6 shows how these radiators are connected. The supply is connected inside traps at the base of risers, the connection being taken off the top so as to exclude the condensation coming down from above. An air line and air-line trap is connected from these radiators to riser return beyond trap to siphon out the air. The radiator return is connected directly into wet return without valve or trap. The steam hand valve on the supply is all the control necessary.

A novel feature of this installation is the vacuum pump which may be turned on or shut off without bothering with the valves on the boiler, except those to cut out the receiver. Fig. 4 shows how the vacuum pump is connected; shutting or opening valves A and B is all that is necessary. The wet return is carried above the water-line of the boiler so as to produce a false water-line. The vacuum air valves on the radiators prevent an influx of air to destroy the vacuum produced by the pump.

Hibbard Apartments, Detroit

With this arrangement the pump is only operated about two or three hours per day, as against continuous operation if a two-pipe vacuum system had been installed.

Fig. 4 shows how the boilers are hooked up to equalize the water-line and provide connections to the pumps. The wet return and two dry returns enter the lower header, with checks so arranged that when the line to the receiver is open it forms the suction pump; otherwise the job acts as a gravity return, and condensation passes into the boiler.

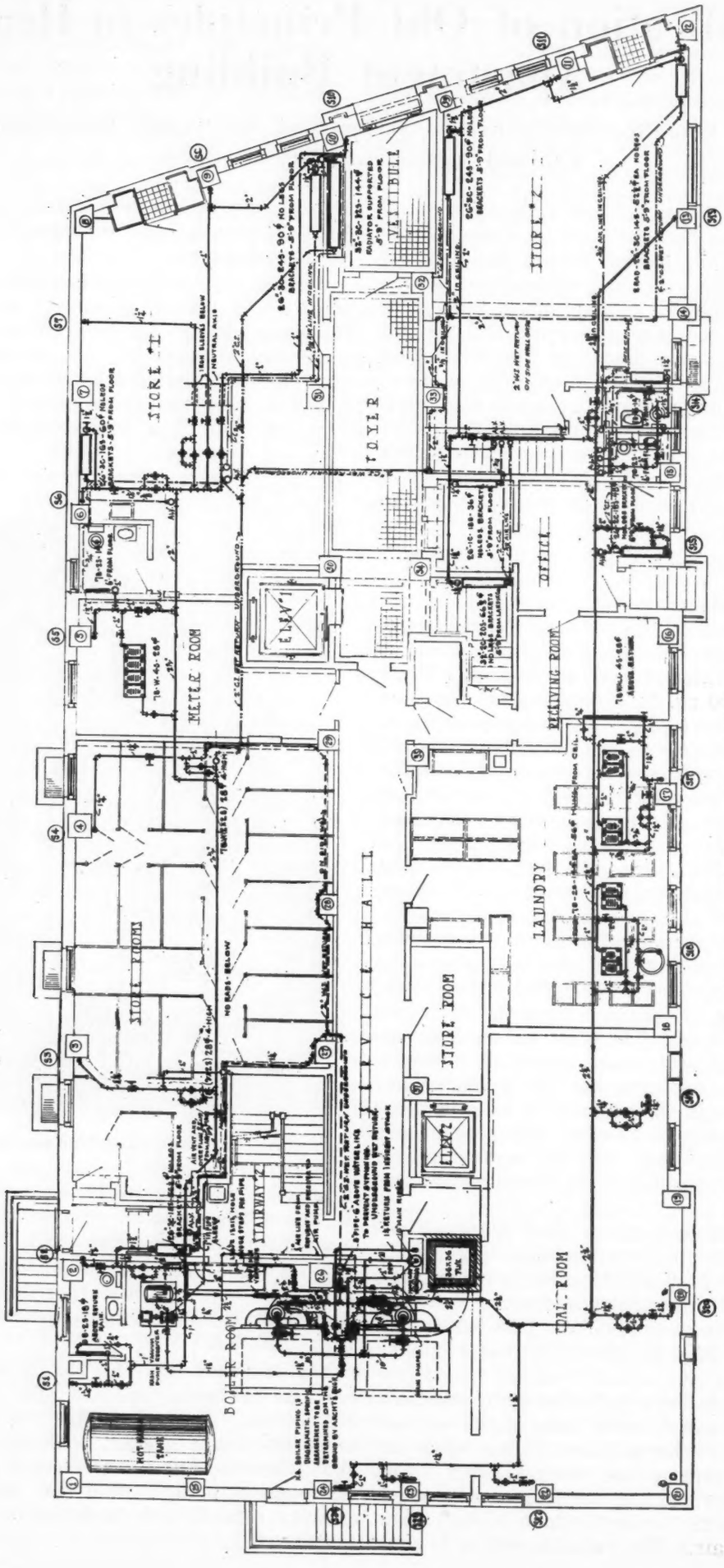

Fig. 1. Ground Floor Plan, Hibbard Apartments

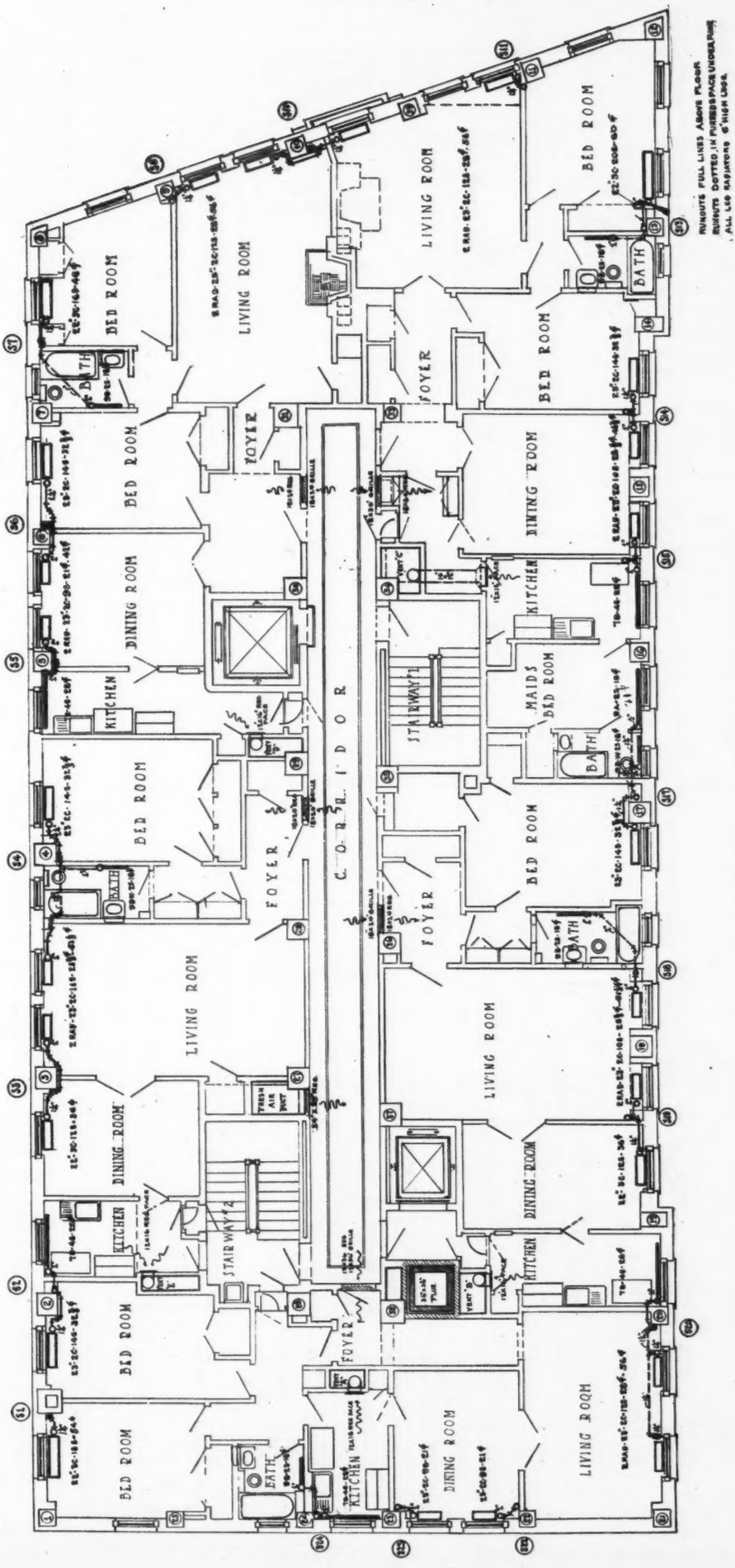

Fig. 2. Typical Floor Plan, Hibbard Apartments

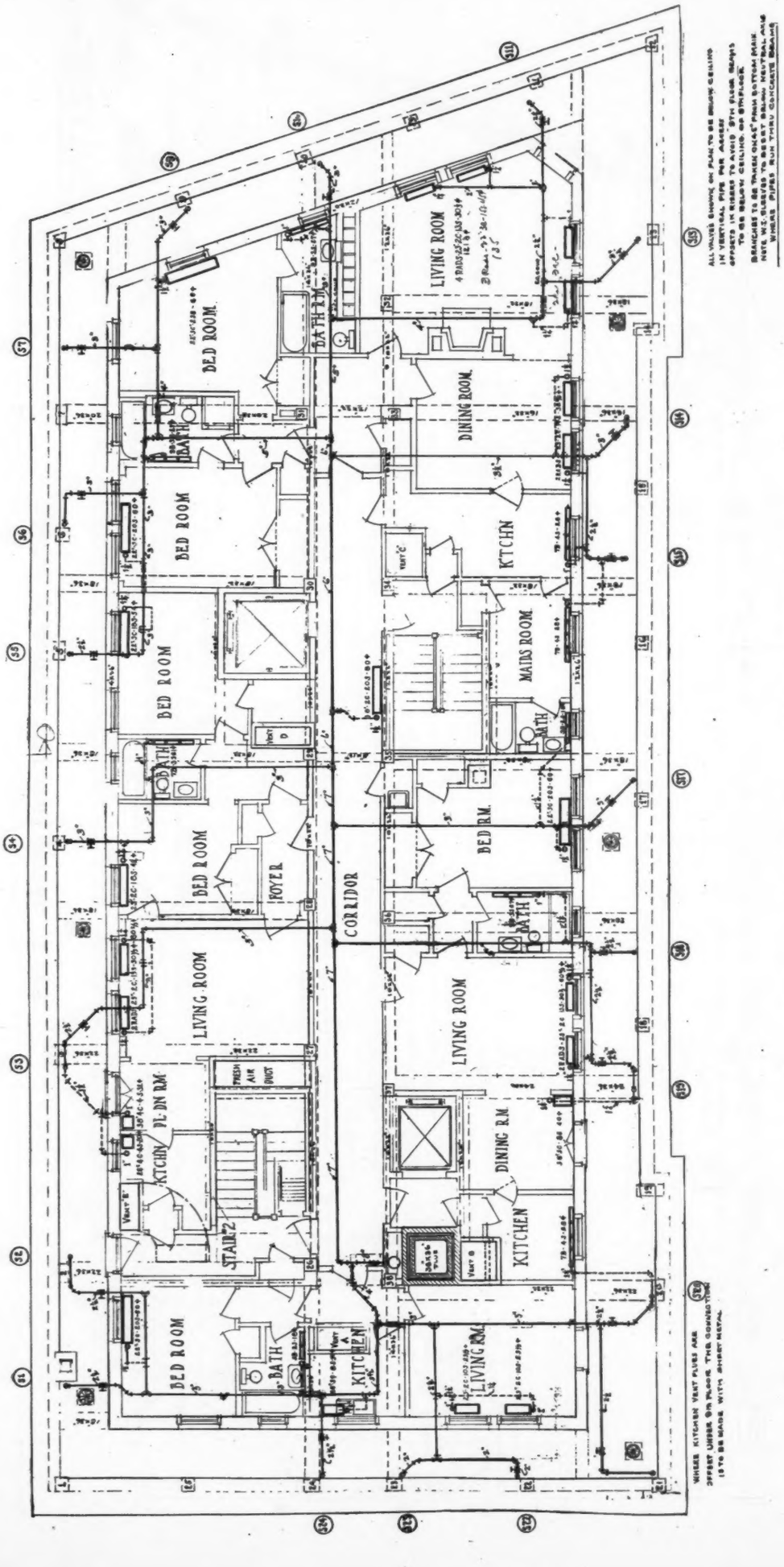

Fig. 3. Ninth Floor Plan, Hibbard Apartments

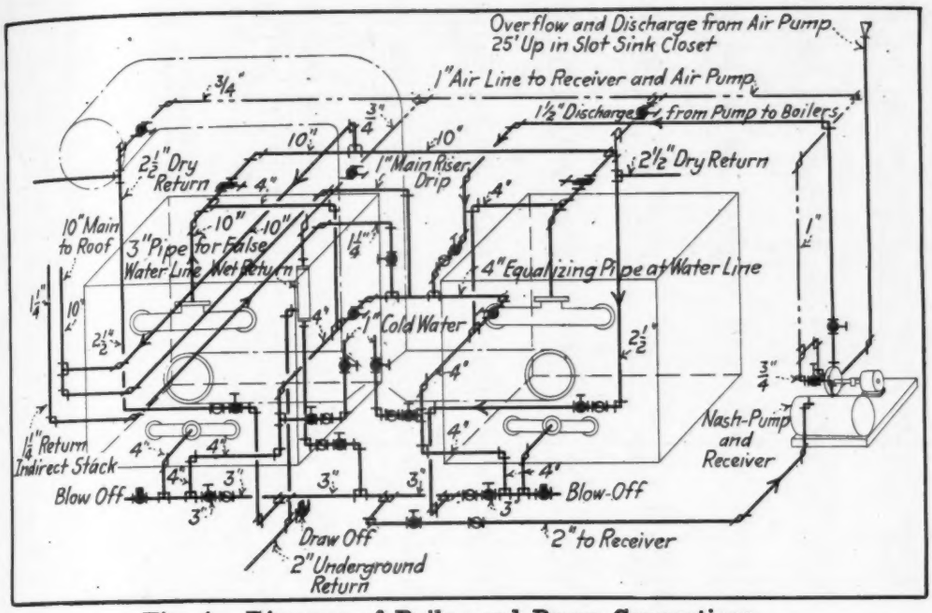
Overflow and Discharge from Air Pump 25' Up in Slot Sink Closet
1" Air Line to Receiver and Air Pump
1½" Discharge from Pump to Boilers
2½" Dry Return
1" Main Riser Drip
2½" Dry Return
10" Main to Roof
3" Pipe for False Water Line Wet Return
4" Equalizing Pipe at Water Line
1" Cold Water
Nash-Pump and Receiver
¼" Return Indirect Stack
Blow Off
Blow-Off
Draw Off
2" Underground Return
2" to Receiver

Fig. 4. Diagram of Boiler and Pump Connections

A Nash pump and receiver is installed, motor-driven, good for 16,000 sq. ft. of radiation, and three air lines are connected to the receiver from each return line. The water connection below and air lines above equalize the pressure on the returns so that water and air are separated, in passing to the receiver, shutting off valves No. 1 and No. 2 on the receiver.

Shutting down the pump is all that is necessary to change over to gravity return, and as high as 10 in. of vacuum may be carried on the receiver without upsetting the circulation in any way. The building heats from top to bottom with a pressure of ½ lbs. below atmosphere at the boiler to 8 lbs. above, without noise.

When pressures above atmosphere are carried it is unnecessary to operate the pump. In Fig. 4, note the two 4-in. lines from the steam main to the return and the connection at the water line. It is intended to keep this 4-in. line half full of water so that when the boilers are operated in battery the water-lines will equalize. These boilers have been found to equalize under all conditions of pressure as concerns the water-line.

The upper 4-in. equalizing pipe receives the return from indirect stack drip from main 10-in. riser and discharge from vacuum pump, without traps, the water from this equipment passing direct to the boiler without passing through vacuum pump.

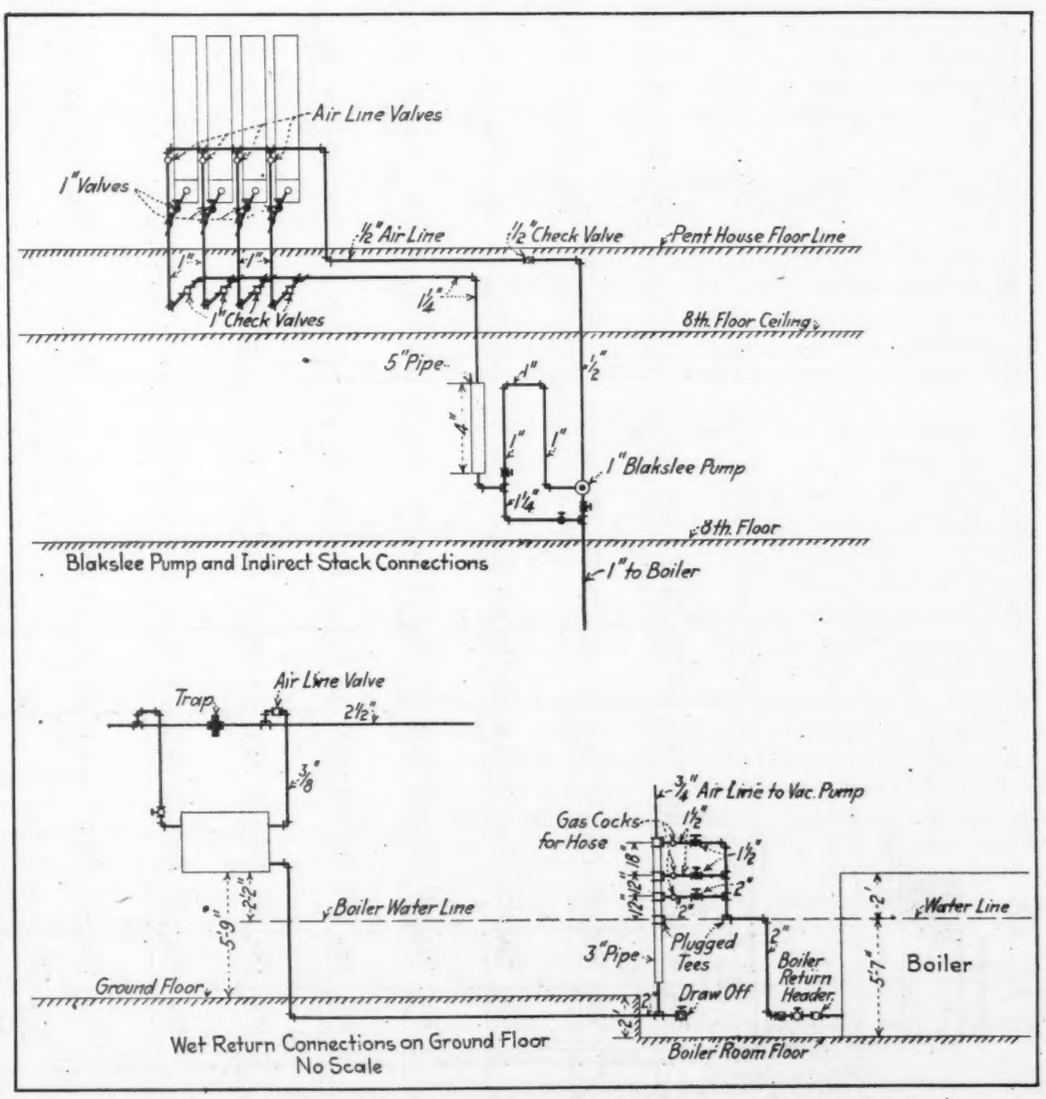

Fig. 6. Pump and Indirect Stack and Wet Return Connections

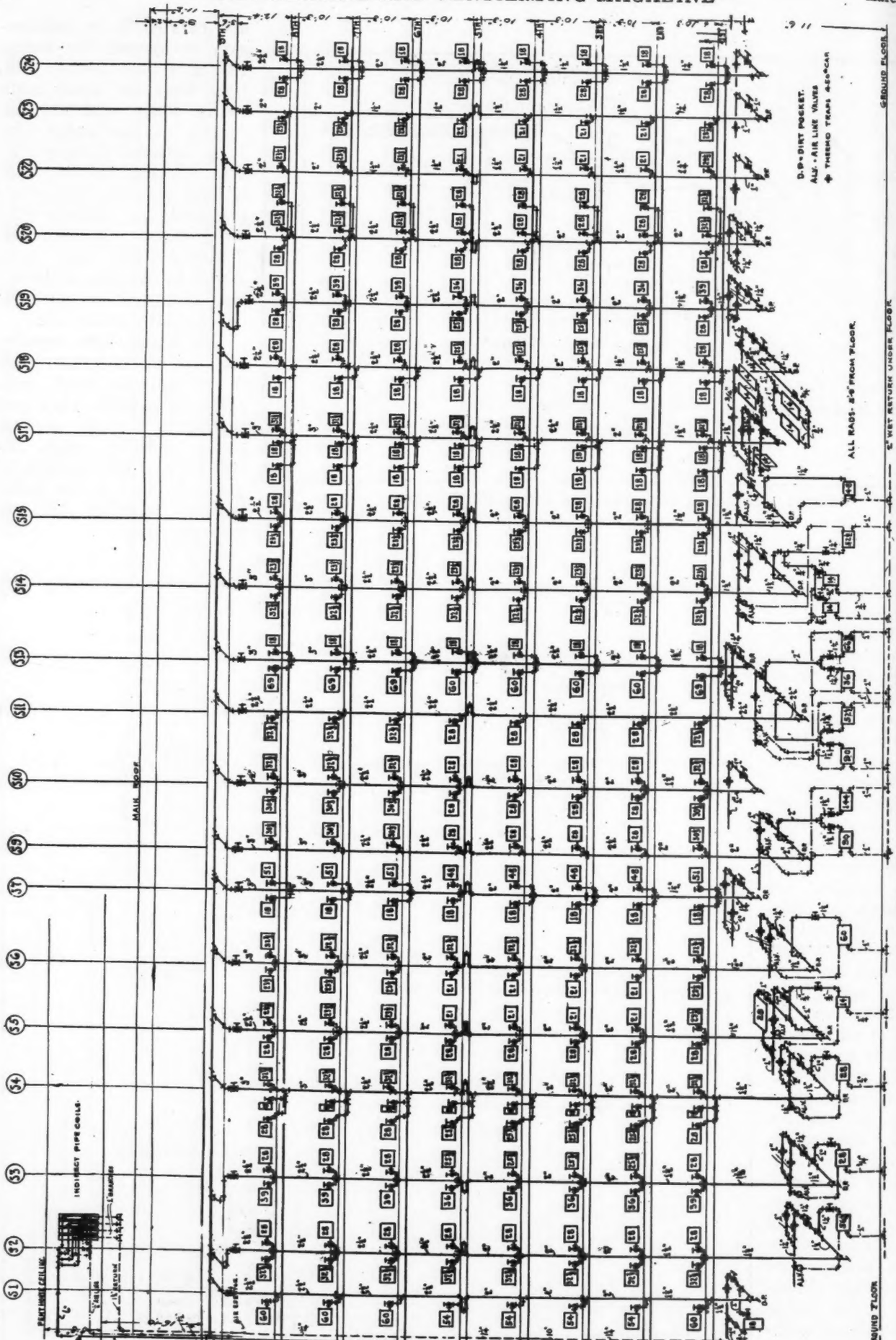

Fig. 5. Riser Diagram, Hibbard Apartments

VENTILATING SYSTEM

Due to the fact that the code requires an outside window in all halls of apartment houses a forced ventilating system was installed in pent house to supply fresh out-door air warmed to 70° F. for all corridors.

The fan is a No. 7 single-inlet service fan built by the American Blower Company, belted to a 7½-H. P. alternating-current motor. The fan capacity is 20,000 cu. ft. of air per minute against ¾ oz. pressure.

The indirect stack in the pent house is comprised of four sections, 25 pipes, 6 ft. high, aggregating about 900 sq. ft. of heating surface.

There is no air-pipe connection between coil and fan, the coil setting in front of an opening controlled by an automatic shutter manipulated from the boiler room by air pressure. The first coil is operated by hand, the other three by a duct thermostat of three-point type.

The air is discharged through a vertical duct and louvre-controlled register in each corridor. Over the door of each apartment is a register to allow movement of air from corridors into each apartment. Fig. 6 shows how air and water are removed from the indirect stack. A 6-in. supply line is connected from the top of the vertical supply riser, with 3-in. connection to each base.

The returns are all connected separately under floor of pent house with Dunham traps to an 1¼-in. line to a piece of 5-in. pipe at about the eighth floor level, so arranged that there is an accumulation of water to operate the Blakeslee pump. This pump has an exhaust and supply from the air vent of each stack through a Dunham air-line trap. As the 5-in. pipe fills and the seal is overcome, the condensation of stack forms the power to suck the air out of the coils. The discharge is connected to an equalizing pipe, heretofore described, at the boiler, 100 ft. below, the column of water producing the power to remove the air. This system automatically and efficiently exhausts the air from the indirect stack.

In the kitchen of each apartment is a vertical vent shaft for exhausting air from the apartments. To prevent any backing down and to adjust the velocity through the register and main flue, a register box and 5 ft. of 10-in. pipe are extended into each vent shaft from each register face. Above the roof there are rotary ventilators to remove the exhausted air. It was found that this fresh-air supply system used no more steam when operating than when idle.

This is accounted for by the fact that people are prone to leave windows open and radiators turned on and there is a considerable interchange of air from without. When the fan was operated a plenum was produced in the rooms, preventing the outdoor air from entering the window to the same extent, and the fresh air at one point handled by the fan did not amount to the same interchange as the innumerable open windows.

The boiler load, it was found, did not increase on starting the fan and the temperature was raised in all apartments as the influx of fresh cold air through the windows was reduced. This caused tenants to shut the radiators off due to increased temperature.

The job has been in operation all this winter and has given excellent results with very low operating pressures. It is almost possible with a job of this type to omit individual air valves on the radiators entirely as the air is almost completely withdrawn by the vacuum pump. As the traps on the risers are very large, there has been no tendency to clog with dirt and the trouble from the clogging of individual radiator traps has been avoided.

The whole plant was installed at a price of about $2.70 per square foot of direct radiation and for less than a two-pipe vacuum system.

The plant was designed by Ira N. Evans, engineer, for R. O. Derrick, Inc., Detroit, architects, and installed by the Lorne Plumbing & Heating Co., of Detroit.

Dont's on Theatre Ventilation

(*Continued from page 55*)

from the rear; the thickness or absence of hair, the height of the collar or neck covering, all affect the results. The face is accustomed to variating temperatures and velocities and the tolerance to such variations is fairly uniform. Variations, even mistakes in introductions from the front, may pass unnoticed where the same variations or mistakes in air from the rear will cause serious complaint and may be the cause of condemning the system.

10. *Don't Expect a Thermostat on The Main Floor to Maintain Conditions of Comfort in The Balcony, or Vice-Versa.*—Balconies and galleries should always have separate air supply units and separate temperature control, as the quantity of air introduced and its temperature requirements are practically never the same in both locations. The additional expense of separating and separately controlling main floor, balcony and gallery, is always justified by the additional advantages.

11. *Don't Supply Air to The Main Floor and Balcony, or to The Main Floor and Dressing Rooms With The Same Fan.*—Air temperature requirements vary so widely in these locations that the only safe procedure is to use a separate air supply. The writer has in mind a particular instance where the air supply for the dressing rooms and for the auditorium proper was from the same fan. In the morning before the auditorium was occupied, relatively high temperature air was introduced to warm the auditorium to a comfortable point. At this time, the dressing rooms, recital rooms, etc., were occupied and the warm air, combined with the heat of the occupants, brought the temperature to a point much higher than was desirable for either health or comfort. It was necessary to install a separate supply fan for the dressing rooms before the condition could be corrected.

12. *Don't Expect Air Currents To Follow Trained Arrows on The Plans Unless You Are Sure The Arrows Are Thoroughly and Properly Trained.*

13. *Don't Expect a Rolls-Royce Ventilating System at The Cost of a Ford.*

This is the fifth lesson of

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Lesson No. 5.

IN ALL previous consideration of heat losses, it has been assumed that ceiling heights were not greater than 12 ft. The specified room temperature in the preceding discussion and assigned problems has referred to the temperature of the air as measured at the breathing line considered to be approximately 5 ft. above the floor.

The temperature at this height has therefore been used as the average temperature of the air in contact with the walls, windows and other parts of the room or building through which heat therein is transmitted to adjoining space.

EFFECT OF CEILING HEIGHT ON TRANSMISSION LOSS

If heat losses are to be calculated for buildings where the ceiling height of rooms exceeds 12 ft., suitable corrections should be made for the average temperature of the air in contact with wall and other heat transmitting surfaces, the temperature of which will exceed that at 5 ft. or breathing level.

According to Reitschel, the average mean temperature in rooms with very high ceilings never exceeds 1.15 times the temperature at the breathing level. He presents a formula whereby the mean temperature of any room with ceiling height exceeding 12 ft. may be determined. It may be applied as follows:

First: Subtract 10 from the ceiling height.
Second: Multiply result FIRST by 0.017.
Third: Add 1 to result SECOND.
Fourth: Multiply temperature at breathing line by result THIRD and obtain the average tempera-

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ture of the air in contact with transmitting surfaces. Thus to determine the mean temperature in a room having a ceiling height of 16 ft. when the temperature of the air at the breathing line is 70° F., the above four-step form is applied as follows:

First: 16 ft. (ceiling height) — 10 ft. = 6 ft.
Second: 6 ft. × 0.017 = 0.102
Third: 0.102 + 1 = 1.102
Fourth: 70 (temp.) × 1.102 = 77.14° F.

Work Problem No. 63

AUXILIARY SOURCES OF HEAT SUPPLY

In addition to the quantity of heat introduced into a room by one of the methods previously described, there are other sources which might be termed auxiliary sources of supply.

Persons give up bodily heat and where large groups assemble in one room, the total quantity of heat given off may amount to a relatively large part of that required per hour to maintain the desired inside temperature. Lights, motors and machinery also impart heat to the air of the room in which they are located.

Ordinarily, the quantity of heat emitted by persons, except in cases of assembly halls and theatres, is not sufficient to be taken into account when making heat requirement calculations. Nor should that from lights, motors and machinery be included as an auxiliary supply unless positive assurance is had that the quantity generated by such auxiliary sources will always be available when the required inside temperature is to be maintained. On the other hand, enough heat may be generated by machinery, etc., in a given room to supply more than is needed for the maintenance of a specified temperature within that room, thus necessitating that provision be made to remove instead of supply heat.

Motors and machinery which they drive when located in the same room, convert all the electrical energy supplied into heat. This heat is retained in the room unless the manufactured product is removed from the room with a temperature higher than that maintained in the room.

In the case where power is transmitted to the machinery from outside the room, then only the heat equivalent to the brake horsepower supplied is converted.

Table 27 contains data, for stated conditions, by which the total heat emitted or developed by persons, lights, motors and machinery may be calculated for stated conditions. In high-powered mills, the heat from the motors and machinery is the chief source of heating and frequently is sufficient to overheat the building, even in zero weather so that cooling by ventilation throughout the year is necessary.

Work Problems Nos. 64, 65 and 66

APPROXIMATE ESTIMATE OF HEATING PLANT SIZE AND FUEL REQUIREMENTS

The preparation of heating and ventilating designs, especially in connection with large buildings often requires that an estimate be made of the maximum and average demand for heat, together with an estimate of the amount of fuel required. It may also be desirable to prepare a load curve to show the quantity of fuel or heat-demand for each of the months of the heating season.

It is customary, as covered in preceding lessons, to base calculations for heat losses on an outside temperature of 0° F. and on an inside temperature of 70° F. In many localities, zero weather may occur only in January or February and then only during the early morning hours and lasts for never more than three to four hours at a time. The maximum demand for heat thus obtains for very short periods so that during the greater part of the heating season, the actual demand for heat is a relatively small part of the total designed boiler capacity.

For large and important designs, a temperature fluctuation chart should be used. A chart of this kind should contain four curves, as shown on the typical chart illustrated in Fig. 10. The data required for preparing a temperature-fluctuation chart should be obtained from hourly weather bureau records taken at or near the locality in question, or by personal observation extending over a sufficiently long period or from reliable heating and power plants log records of a nearby station.

The scale on the left of the chart represents outdoor temperatures with a range of 0° F. (at top) to 70° F. (at bottom). Extending across the top are 24 equal divisions representing the 24 hours of a day.

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All submitted work will be received on paper cut to the same size as the lessons so that when a student has completed the course he will possess a complete reference work on the subject, thoroughly indexed, which will prove invaluable to him in his future work.

TABLE 27. HEAT EMITTED BY PERSONS, LIGHTS, MOTORS AND MACHINERY

OBJECT	CONDITION			B.T.U. PER HOUR EMITTED
PERSONS	AT REST			400
	AT WORK			500
	AT VIOLENT EXERCISE			650
LIGHTS	ELECTRIC LAMPS			THE PRODUCT OF WATTS PER HOUR × NUMBER OF LAMPS × 3.415
	GAS PER CU. FT.		PRODUCER GAS	150
			ILLUMINATING GAS	700
			NATURAL GAS	1000
			ALLOW FOR WELSBACH BURNER = 3 CU. FT. PER HOUR	
			ALLOW FOR FISH TAIL BURNER = 5 CU. FT. PER HOUR	
	B.T.U. EQUIVALENT TO 1 HORSEPOWER HOUR = 2546. THE PRODUCT OF HORSEPOWER OF MOTOR × 2546 DIVIDED BY EFFICIENCY OF MOTOR			
MACHINERY	THE PRODUCT OF THE DEVELOPED (BRAKE) HORSEPOWER × 2546			

The curve marked "coldest day" was prepared by plotting on each hour line, the temperature existing at the time. For example, at 9 A. M., the temperature was 5° F. (see heavy dotted arrowed lines) for locality for which this sample chart is prepared. In like manner, the curve for "coldest month" is obtained by averaging the temperatures at each respective hour for all days of the month and plotting these values as explained for the "cold day" curve; similarly for the "warmest month" curve. The "season average" curve is obtained by averaging all temperature readings for the same hour during the entire heating season.

The scale on the right of the chart is divided into 20 parts each of which represents 5%. By designing, for 0° F. temperature outside and 70° F. inside, the total boiler capacity represents 100%. With the aid of the curves as plotted, the estimated percent of boiler capacity required at any time of the day may be read as follows:

Assuming that it is the coldest day for the locality at 3 P. M., it is noted that the "coldest day" curve, for this hour intersects the 80% line, showing that this percentage of the total boiler capacity will be required.

Work Problems Nos. 67 and 68

Temperature fluctuation charts may be prepared so as to show curves for each month of the heating season but it is not intended at this point in the course to do more than give the student a general idea of the use of such charts.

LOAD CURVE

Let it be assumed that the following represents average monthly temperatures for a given locality during the heating season:

	Temp. Deg. F. Out-side	In-side	Diff.	Average Heat. Demand
October	55	70	15	21.4%
November..	42	70	28	40.0%
December ..	26	70	44	62.8%
January ...	21	70	49	70.0%
February ..	23	70	47	67.1%
March	35	70	35	50.0%
April	52	70	18	25.7%

Since the demand for heat will vary according to outside temperature changes, the percent of average heat demand per month may be found by dividing the difference between the inside and outside temperature by the inside temperature and multiplying by 100. Thus if the outside temperature is 0° F., and inside temperature 70° F., the difference is 70° F. which, divided by 70° (inside temperature) × 100, indicates the heat demand to be 100%; in the case of the month of January when the average outside temperature is 21° F. the difference is 49° F. and $(49 \div 70) \times 100 = 62.8\%$.

Similar values for the assumed monthly temperatures given above are tabulated in the last column.

These average heat-demand values for each month are used to prepare the load curve shown in Fig. 11. The horizontal divisions to represent months are made any convenient length, while the height of the curve for any month corresponds to the percent demand as developed above. For example, the height for October is 21.4%, the total height of the chart, while that for January is 70%. The average demand for the season may be indicated by averaging the percent. heat-demands for all the months. In the selected example, this amounts to 48.14% and is indicated by the line so marked on the chart.

Thus far, the consideration of the load chart has been in general terms. To apply it to actual fuel requirements for a particular installation, it is necessary to consider local physical conditions which, if not known, may be assumed for the pur-

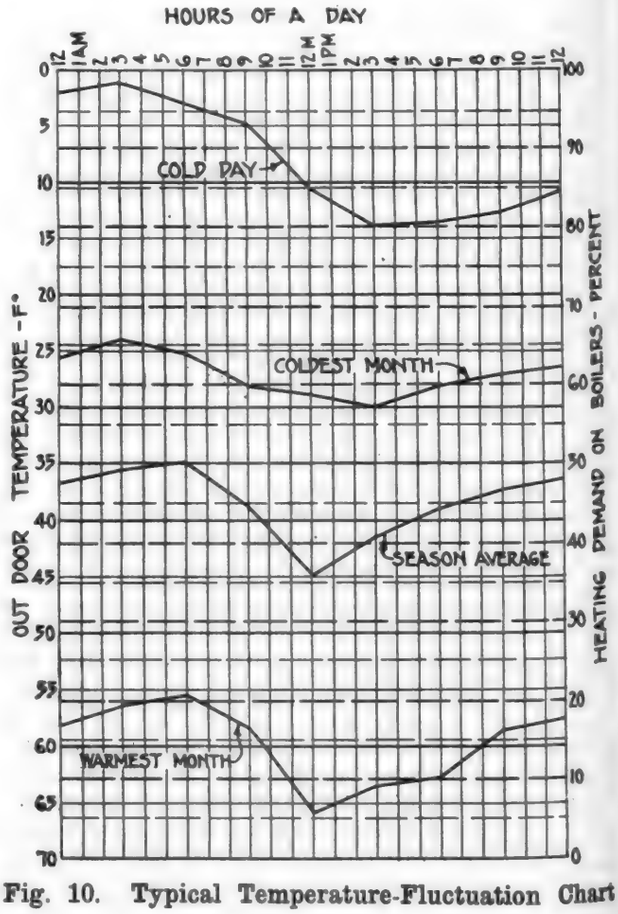

Fig. 10. Typical Temperature-Fluctuation Chart

pose of application. These include the total equivalent square feet of direct radiation in the building or for which heat is demanded, the total number of hours that the system will operate during a heating season and the kind and grade of fuel used.

ESTIMATING FUEL REQUIREMENTS PER HEATING SEASON

Knowing the factors mentioned in the last sentence, the total fuel required per heating season may be estimated so as to give a close approximation of what the fuel consumption should be under fair operating conditions. The following method may be used:

First: Note the total equivalent square feet of direct radiation required or installed, based on 0° F. outside and 70° inside.

Second: Multiply result FIRST by the number of hours per day that heat will be required.

Third: Multiply result SECOND by the number of days that heat will be required.

Fourth: Multiply result THIRD by the number of B.T.U. given off per hour by each square foot of direct radiation.

Fifth: Multiply result FOURTH by the average demand for season, (see Fig. 11, this may usually be assumed at 50%), and obtain the total B.T.U. that will be given off by the entire system during a heating season.

Sixth: Multiply the heat value of the fuel used (B.T.U. per pound) by 2000 and obtain the total B.T.U. per ton of coal. (If oil is used, the heat value per pound or per gallon should be used and the constant 2000 omitted).

Seventh: Assume an overall boiler efficiency (usually 65%) and multiply SIXTH by this factor to obtain the net B.T.U. per ton for coal (or per pound or per gallon for oil), imparted to the heating medium.

Eighth: Divide result FIFTH by result SEVENTH and obtain the total tons of coal required per heating season; or the total pounds or gallons of oil.

The eighth-step form is applied as follows for the following conditions:

Total equivalent square feet of direct radiation = 3258.

Hours per day heat is required = 24.

Days per heating season = 240.

B.T.U. given off per square foot of radiation = 250.

Average demand for season = 50%.

Heat value of coal = 13250 B.T.U. per pound.

Efficiency of plant = 65%.

APPLICATION OF EIGHTH-STEP FORM

First: 3258 sq. ft.

Second: 3258 (sq. ft.) x 24 (hrs. per day) = 78,192.

Third: 78,192 x 240 (days) = 18,765,080

Fourth: 18,765,080 x 250 = 4,691,270,000

Fifth: 4,691,270,000 x 0.50 = 2,345,635,000

Sixth: 13,250 x 2000 = 26,500,000.

Seventh: 26,500,000 x 0.65 = 17,225,000.

Eighth: 2,345,635,000 ÷ 17,225,000 = 136 plus tons.

Work Problems Nos. 69 and 70

MONTHLY REQUIREMENTS BY LOAD CHART

In order that the monthly fuel requirements for a particular installation may be closely approximated, the load chart should be amplified to show the percent of the season's fuel demands that will be required each month during the heating season. These are indicated by the percentages noted in the lower part of the cross-hatched part of the chart, the values being obtained by adding the heat demand percentages for all months and dividing each respective monthly demand by the sum of all and multiplying by 100 to express it as a percentage. Thus the total of all demands is 21.4 plus 40.0 plus 62.8 plus 70.0 plus 67.1 plus 25.7 = 337.0 and the percent fuel required for October is (21.4 ÷ 337.0) × 100 = 6.4%. In like manner, the percentages as noted for the other months are obtained.

With such a chart prepared for a particular installation, a ready means of checking the monthly consumption of fuel is available and by comparing the monthly temperatures with those representing average conditions, leaks may be detected and correction methods applied before accumulated losses have become exceedingly large.

So, if the season fuel requirements for a particular installation are determined to be 136 tons, and the January temperatures represent average conditions, the consumption of coal to be expected during this month would be 136 (tons) × 0.208 = 28.3 tons for a locality to which the load chart of Fig. 11 was applicable.

Work Problem No. 71

ESTIMATING BOILER CAPACITY (APPROXIMATE).

In the preceding discussion, it has been assumed that the heating system has been designed or is in operation. Estimates of probable boiler capacity are often desired before going to the expense of preparing a complete heating design.

Such an approximate estimate may be made from the architect's preliminary plans in terms of the probable transmission losses as follows:

First: Multiply total exposed wall surface in square feet by 21 and obtain heat units lost per hour through the wall.

Second: Multiply total area of window openings in square feet by 70 and obtain heat units lost per hour through the glass.

Third: Multiply total lineal feet of window and door openings by 72 for ordinary construction (use 31 for metallic stripped sashes) and obtain the heat units required per hour to care for infiltration.

Fourth: Add results, FIRST, SECOND, THIRD and add 15% of this total for line losses.

Fifth: Divide result FOURTH by 30,000 and obtain the boiler horse power per hour necessary to meet the most severe weather conditions (assume 0° F. outside and 70° F. inside).

Sixth: Refer to a temperature-fluctuation chart for the locality in question from which the average percent heating demand on boilers may be determined for the season or during the coldest, or warmest month.

Work Problem No. 72

FUEL REQUIREMENTS BASED ON APPROXIMATE BOILER CAPACITY

Fuel requirements may be based on a preliminary boiler estimate by dividing the result obtained under FOURTH in the six-step form directly above by 250, representing the number of heat units given off by every square foot of direct radiation. Thus an approximate figure is obtained for the total equivalent square feet of radiation required.

With the square feet of equivalent direct radiation known, procedure is as explained by the eight-step form given under "Estimating Fuel Requirements per Heating Season."

Work Problems Nos. 73 and 74

EQUIVALENT TEMPERATURE GUARANTEES

Practically all heating contracts contain a clause guaranteeing specified inside temperatures for a given outside temperature. Tests of the system to determine how well it will fulfill its requirements must often, if not usually, be made when the outside temperature differs from that stated in the contract.

This makes it necessary to compare temperatures obtained under test conditions with those as given in the guarantee clause.

The actual inside temperature to be maintained by a heating system for other than the inside and outside temperatures named in the contract may be obtained in the following manner:

First: Multiply the guaranteed inside temperature by the actual outside temperature during the test.

Second: Add the actual outside temperature to the guaranteed inside temperature.

Third: From result SECOND, subtract the outside temperature stated in the guarantee.

Fourth: Multiply result THIRD by the temperature of the heating medium within the radiator.

Fifth: From result FOURTH, subtract result FIRST.

Sixth: From the temperature of the heating medium within the radiator, subtract the outside temperature stated in the guarantee.

Seventh: Divide result FIFTH by result SIXTH and obtain the actual inside temperature required under test conditions.

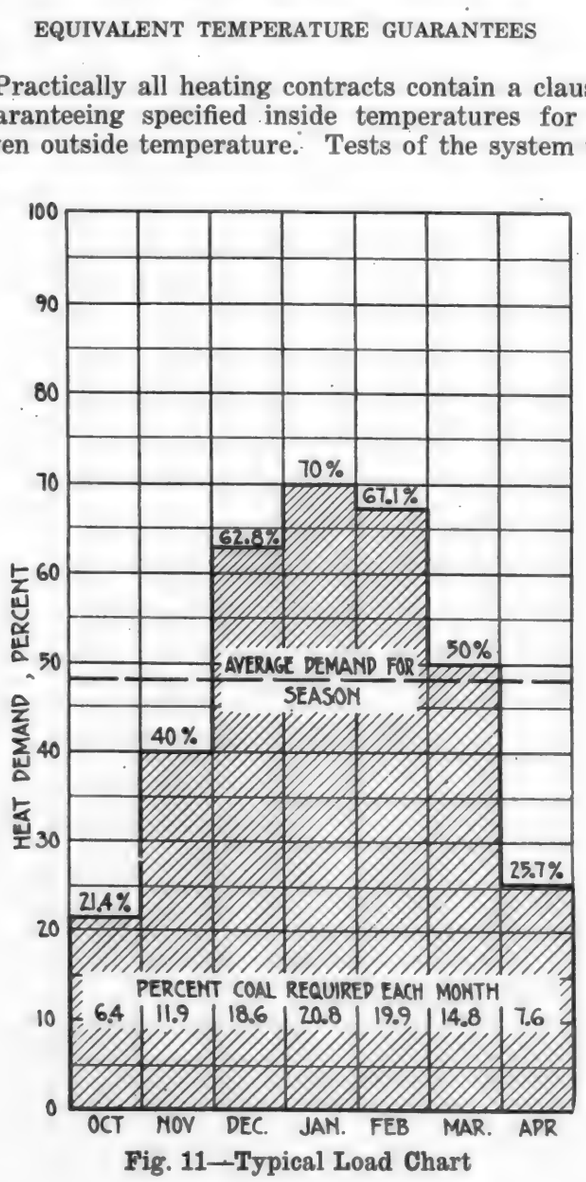

Fig. 11—Typical Load Chart

APPLICATION OF EQUIVALENT TEMPERATURE GUARANTEE FORM

The above form may be applied for a selected example as follows: A contract requires that a heating system shall be capable of maintaining the inside temperature at 70° F. when the outside temperature is 0° F. and steam is supplied the radiators at a pressure of 5 lbs. per square inch (temperature of steam at this pressure is 227° F.).

Required:—the inside temperature to be maintained with the system tested when the outside temperature is 30° F.

First: 70 (guar. inside) × 30 (test out.) = 2100.

Second: 30 (test. out.) plus 70 (guar. inside) = 100.

Third: 100 — 0 (guar. out.) = 100.

Fourth: 100 × 227 (temp. steam) = 22,700.

Fifth: 22,700 — 2100 = 20,600.

Sixth: 227 (temp. steam) — 0 (guar. outside) = 227.

Seventh: 20,600 ÷ 227 = 90.9° F.

Work Problems Nos. 75, 76 and 77

This lesson concludes the section devoted to the fundamentals of heating and ventilating. The second part of the course, devoted to gravity water heating will begin in the next issue. The first lesson will include pipe sizing methods, principle of gravity water heating, direct return layouts, reversed return layouts, determining radiator valve and pipe sizes of mains, styles of branch connections, riser and radiator connections, eccentric fittings, and proportioning for given radiation.

How To Select A Pressure-Reducing Valve

*By William Sommer**

WHENEVER a pressure-regulator, pressure-reducing valve, or any throttling device is put into a steam, air, water, or oil line the question arises as to how much the pressure will be reduced by it. The accompanying discussion deals especially with steam pressure-regulators, but the same method can be extended to any throttling device and to other fluids.

With pressure regulators, the initial pressure and the service pressure are fixed, according to which the regulator has to be installed. The capacity is generally determined very roughly with reference to the sizes of the inlet and the outlet only. But are these really the principal features of a pressure regulator with regard to its capacity?

The smallest orifice through which the steam has to pass is really acting as the pressure-reducing part. This smallest orifice is not formed, as a rule, either by the inlet or by the outlet of the regulator, but by the opening between the regulating valve and its seat. Fig. 1 shows different types of pressure-regulators with different-shaped openings. Therefore the capacity of a pressure-regulator is to be determined generally by the initial and service pressures and by the regulating orifice when the valve is fully open.

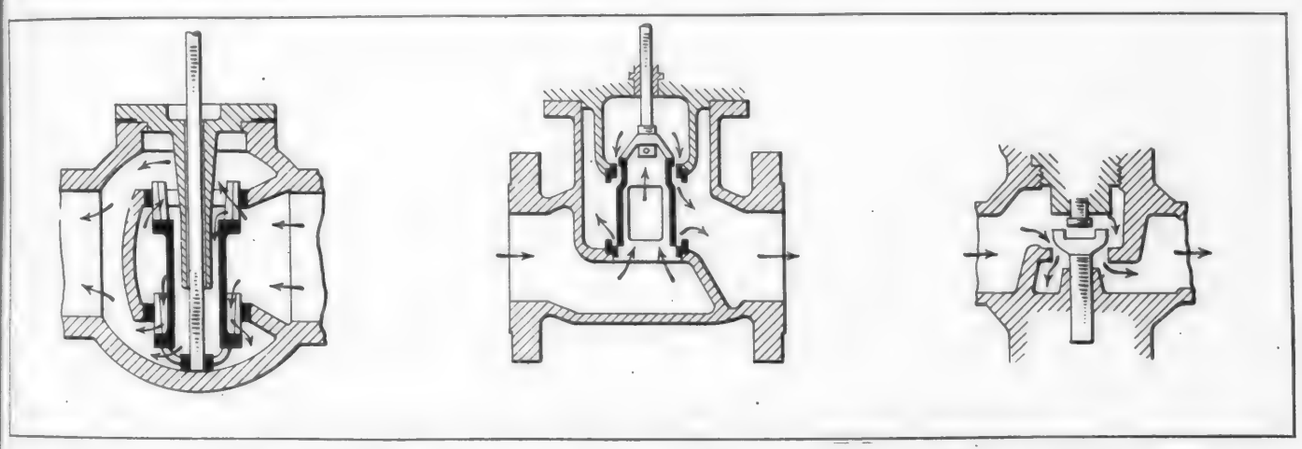

Fig. 1. Different Types of American Pressure-Reducing Valves

Let us see, then, how much steam of an initial pressure, p_1, flows through an orifice "a" into the space of the service pressure, p_2. At a given initial pressure, p_1, and with a given orifice of 1 sq. in., (Fig. 2) the discharge of steam depends only upon the service pressure, p_2. The amount of steam, Q, increases as the service pressure is diminished until it reaches a certain percentage of the initial pressure, called the critical pressure. Any further decrease of the service pressure does not increase the amount of steam passing through, even to the extent of the perfect vacuum. The maximum discharge of steam, Q_m, will be obtained, therefore, with a service pressure which is equal to the critical pressure, or lower. The critical pressure is found by the relation:

$$p_m = \beta p_1 \ldots\ldots\ldots\ldots\ldots (1)$$

in which $\beta = 0.545$ for saturated and slightly superheated steam
0.528 for gases.
p_m = absolute critical pressure in pounds per square inch.
p_1 = absolute initial pressure in pounds per square inch.

The maximum discharge of steam under ideal conditions is:

$$Q_m = ax\sqrt{\frac{p_1}{v_1}} - 3600$$

in which $x = 0.306$ for saturated and slightly superheated steam.
0.325 for gases.
a = area of orifice in square inches.
v_1 = specific volume of steam at initial pressure.
Q_m = Maximum discharge of steam in pounds per hour.

Or, for 1 sq. in. area:

$$Q_m = x\sqrt{\frac{p_1}{v_1}} - 3600 \ldots\ldots\ldots (2)$$

Fig. 3 shows the amount of steam through an orifice of 1 sq. in. at a given initial pressure, p_1, and various service pressures, p. This curve was obtained by observing the discharge of steam under ideal conditions. It is found to be an ellipse expressed by the formula:

* Based upon an article entitled, "Ueber die Auswahl der Reduzeirventile," by Dipl.-Ing. A. Eigenmann, of Bologna, appearing in the *Gesundheits-Ingenieur* for September 16, 1924. The author therein gives a chart for determining the sizes of steam pressure-reducing valves, based upon well-known thermodynamic principles, which will be found useful to manufacturers and consulting engineers.

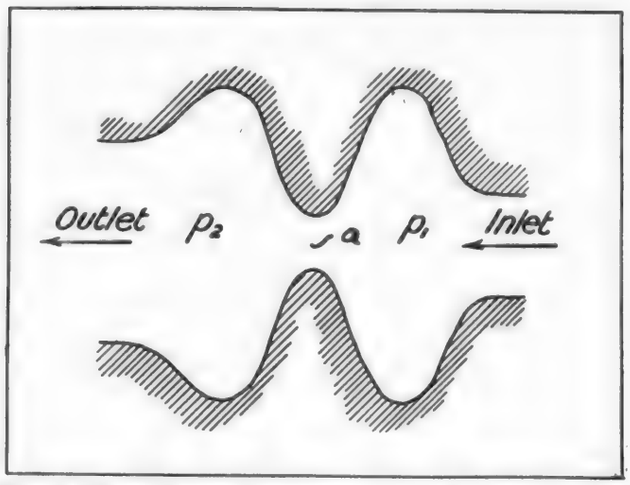

Fig. 2. How Steam Discharge, with a Given Orifice, Depends Only Upon Service Pressure

$$\left(\frac{Q}{Q_m}\right)^2+\left(\frac{p-p_m}{p_1-p_m}\right)^2=1 \ldots\ldots (3)$$

Such an ellipse can be plotted for every initial pressure, p_1, by using relation (2). Thus we obtain a chart (Fig. 4) which shows the amount of steam passing through an orifice of 1 sq. in. for every combination of initial and service pressure. Fig. 4 is plotted for saturated and slightly-superheated steam, but can be used for higher superheats, too, as shown by Example No. 4.

NECESSARY TO USE COEFFICIENTS OF DISCHARGE

The above formulas are limited to ideal cases, never reached in practical operation. There is a certain coefficient of discharge for every orifice which is decreased by contraction of the jet, whirls, badly distributed and sharp-edged slots, condensation, etc. Tests for determining this coefficient have been made and are to be found in the literature on the subject An average of 0.6 may be used for pressure-reducing valves, pressure regulators, etc. Therefore, multiply the amount of steam from the chart by 0.6 to obtain the real discharge (see examples following).

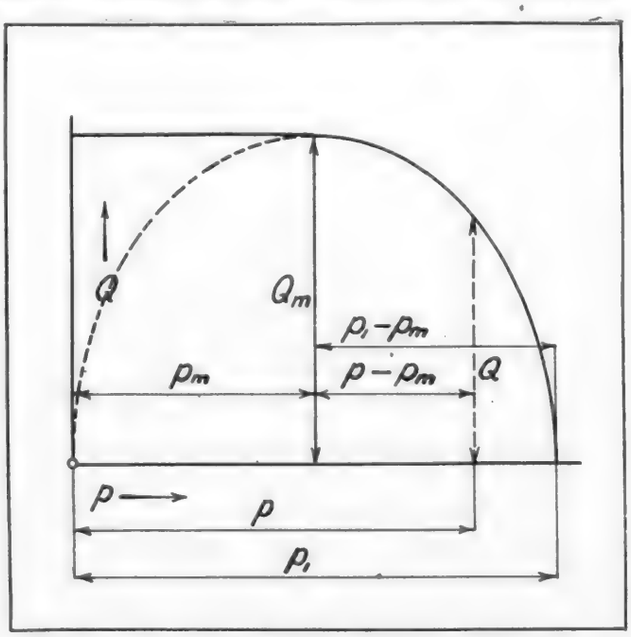

Fig. 3. Amount of Steam Flowing Through an Orifice of 1 sq. in. at a Given Initial Pressure and Various Service Pressures

Much trouble has been caused by choosing pressure regulators in accordance with the sizes of the main and service pipes only. The foregoing discussion shows that a reliable determination is possible by considering the smallest area in the valve. It would be to the advantage of everyone dealing with pressure-reducing valves if the manufacturers would indicate the area between the valve and its seat when the valve is fully open.

EXAMPLES

1. What is the proper size valve, that is, the necessary area "a" for reducing 4420 lbs. of saturated steam per hour from 113.7 lbs. per sq. in. initial pressure to 42.7 lbs. per sq. in. service pressure?

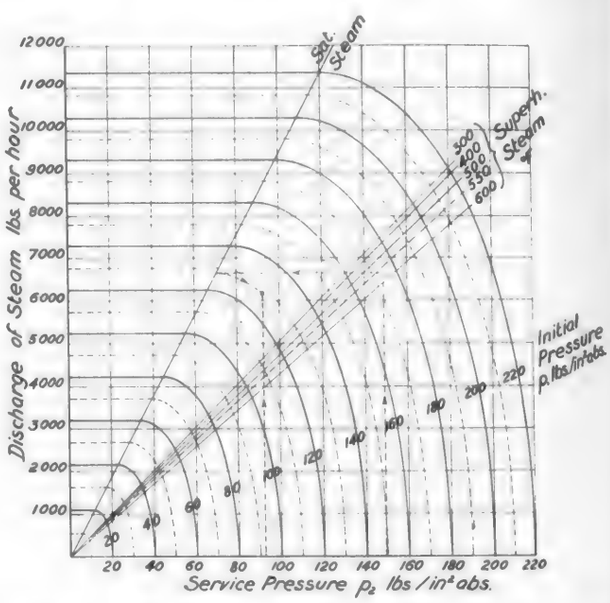

Fig. 4. Discharge of Steam Through Ideal Orifice of 1 sq. in.

The ordinate between 42.7 on the axis of abscissae and the ellipse of 113.7 is 5900 lbs. per hour discharge through the 1 sq. in. ideal orifice. The total idea area, therefore, is 4420/5900=0.75 sq. in., and the real area "a" is 0.75/0.5=1.5 sq. in., the coefficient of discharge being assumed as 0.5.

2. What is the discharge of saturated steam from 185 lbs per square inch initial pressure to 142.2 lbs. per square inch service pressure through a pressure regulator of 2.17 sq. in. valve area, and a coefficient of discharge of 0.6?

Start with the abscissa, 142.2 in Fig. 4 and the ordinate up to the ellipse of 185 gives the discharge per square inch ideal valve area as 8250 lbs. per hour. The total discharge, therefore, is 8250×0.6 ×2.17=10750 lbs. per hour.

3. $p_1 = 149.3$ lbs. per square inch absolute.
$t_1 = 572°$ F.

$p_2 = 92.4$.

Discharge = 66,200 lbs. per hour.

What is the necessary valve area "a," the coefficient of discharge, of the regulating valve being 0.6? Follow the dotted line in Fig. 4, which gives 6190 lbs. per hour for the ideal orifice of 1 sq. in. The necessary construction area, therefore, is $66200/(6190 \times 0.6) = 17.85$ sq. in.

Heating and Ventilating the United States Capitol

The Three Methods Successively Adopted To Date For Furnishing Heat and Fresh Air To The House and Senate Wings

1. The Original System

CONCERNING this work the army officer General M. C. Meigs, in associate charge of designing and installing the first system wrote to his chief, the Hon. J. B. Floyd, then Secretary of War, sixty years ago:

"The most difficult piece of engineering and construction which I have yet had to undertake is the heating and ventilating of the Capitol extensions, (that is, the House and the Senate Wings). There is none which requires more laborious, complicated and tedious calculation, drawings and studies, none which requires so extensive an acquaintance with the general principles of science and physics, of the properties of caloric and its effects on gases and solid bodies. There is none in which so many failures have been made, both in this country and in Europe. The history of the heating of the Houses of Parliament, in England, is a history of failures and blunders, of ignorance and waste."

American history in the same department, and in connection with the legislative wings of the Capitol, makes it appear that defects and waste in heating and ventilating plans and performance are not confined to England.

FIRST METHOD 1858–1906

General Meigs, collaborating with Robert Briggs, consulting engineer from Boston, and with the Nason Company, steam specialists and manufacturers, of New York, designed and installed the origginal system for warming and ventilating the present stately extension structures to the Capitol known as the House (South) and the Senate (North) wings of the Capitol. The present description relates only to the equipments for the warming and ventilating of the committee rooms and the corridors and great stair wells of both wings. The experience with reference to the legislative chambers within these wings will be the subject of subsequent presentation.

The purpose embodied in the design and construction of the systems adopted was to warm the buildings and all contained rooms and other enclosures by means of heat contained in the air passed through them for ventilating processes, ventilation being made generous and the temperature of supplied air being made correspondingly low. The rule of intended procedure might well have been expressed in such terms as "maximum tolerable in air supply, minimum tolerable in temperature of air supply."

ARRANGEMENTS FOR WARMING THE AIR

For warming the air some twenty-six indirect heaters were built into brick-walled chambers located in the sub-basement of each wing. These chambers were connected by means of subterranean air-ways of generous proportions, with a fan chamber in each building. The outside air was drawn through tunnels of approximately 64 sq. ft. cross section, each tunnel terminating at the base of an open topped tower in the park west of the Capitol and some 400 ft. distant from the building. The air supplied to the heating chambers through the towers, the tunnels, the fans and the subterranean airways within the wings was not tempered, or to any degree warmed, except as heat was imparted by the walls of towers, tunnels, subterranean air ways and fan and other chambers.

The air warmed by the steam heaters within the chambers, rising to the top of the chambers, and moving through the heaters and chambers under propulsion by the fans, passed from the chambers to rooms, corridors and stair wells through vertical flue-ways within the massive walls of the wings. The air was made to enter near the floors through heavy hooded outlets which directed the inflowing air floorward, and by which the rate of volume inflow could be controlled. The hoods, or chutes, were hinged at the top, friction upon the two side cheeks holding the hood in any open or closed or intermediate position desired.

For nearly fifty years this provision, as above described in outline, quite imperfectly served its intended purpose. It could not perfectly do so because of certain defects inherent in the design of the systems, and because of deficiencies inherent in the operating human factor.

It was assumed by the designers that the rate of air flow through the heaters and their chambers would be approximately constant, and that the temperature of the air leaving the chambers would be made to vary inversely as the temperature of the outside air fell below 70° F. Failure followed as the result of two errors in the design of the system as described, and of one error in trusting too im-

plicitly upon fallible human nature in making that the prime factor of performance in the operation of the entire systems.

FAULTS IN HEATER CONSTRUCTION

First, as to the heater construction. In design the heaters were planned to provide means for closely, if not perfectly, controlling the temperatures of the air passed through them. In practice they utterly failed of that accomplishment, partly, if not largely, because of the undependable human factor involved in the heavy burden imposed upon it.

The heaters were of the "box" pipe-coil pattern, each vertical trombone coil being connected into a steam manifold at top and a corresponding condensate manifold at bottom. The number of trombone coils, or sections, in the heaters, varied from six for the smallest heater to eighteen for the largest. The number of pipes in vertical order in the trombone sections varied from 14 to 24.

Each one of all these trombone sections, or elements, was valved at both the steam and condensate connections with the respective manifolds, the valves being embodied in the manifolds. The smallest of these heaters so made up was six pipes wide, twelve pipes deep, pipes 2 ft. 9 in. long, exclusive of return bends, and the largest of these heaters eighteen pipes wide, fourteen pipes deep and pipes 8 ft. 7 in. long, exclusive of return bends. Each of the total of 410 trombone elements, or sections, valved at both ends, gave a total of 820 valves for manipulation in the control of the temperature of air supplied to rooms, corridors and stair wells of both wings.

The sixty, more or less, original heaters, in as many widely-separated positions within the great catacomb-like sub-basements of the two wings, became increasingly difficult of access because of storage uses to which the rooms in which the heating chambers were located, were put. The heavy and clumsy cast-iron doors hinged at bottom for providing access to the upper and lower tiers of valves further discouraged the use of those valves as intended. The leakage of steam through closed valves in the upper manifolds, with steam at from 15 to 20 lbs. pressure, carried in distributing mains and feed runouts, resulted in the accumulating of condensate at the bottoms of unused trombone sections of the heaters, and the freezing of such water, attended with the bursting of containing pipes when the temperatures of outside air fell a few degrees below the freezing point.

The surest and easiest way of preventing such freezing was found to be in keeping all sections of all heaters steam filled. That condition further favored relinquishment of the intended use of the heaters, and with the inevitable result of greatly overheating air for passage to the buildings, where controlling dampers were generally neglected, and corridors and rooms and other enclosures became overwarm and "stuffy." The consequent general impression made on occupants of, and especially on visitors to, the Capitol for a space of nearly fifty years has been that of enervating heat and closeness, from all of which there appeared to be no readily available relief owing to conditions of design, construction and operation which could not be easily overcome.

ERRORS IN DESIGN OF SYSTEM

Experience has shown two errors in the design of the system; first, in the method of temperature control involving the human factor to an excessive degree; and, second, in the absence of means for tempering the air before reaching the heaters whose construction and valving exposed all trombone sections unfilled with steam to the liability of freezing in cold weather.

After the system had been turned over to the Government for use under the charge of government-appointed operators, Mr. Briggs, upon making a visit to the Capitol for the purpose of observing conditions consequent upon their work, expressed his judgment by letter to his former employer in the following language:

"As I am persuaded from the examination of the heating and ventilating equipment of the north wing this morning that you do not fully comprehend the relation between the two branches of heating and ventilation, I propose to state in writing what I have often enlarged upon in conversation upon the subject.

"The prime object of the entire apparatus is to give the largest quantity of air at the lowest temperature that will answer to heat the rooms. * * * The occupants of rooms will only tell you when they are too hot or too cold, but that they have enough air—which in the long run is the more important—rests upon your own care and observation.

"Upon you rests the responsibility of the good name, and in fact the continuance, of the whole apparatus.

"If you permit too hot air to flow from the registers you can certainly rely upon the permanent closing of the hot air flues. * * *

"I will assure you that I would choose the worst stoves and the coldest rooms rather than such a heating apparatus (condition) as I found in the north wing this morning. It was with extreme mortification that I found the condition of things," (obtaining within the building).

A National Heating and Ventilating Exposition

Plans are well advanced for a national heating and ventilating exposition to be held in New York, at the time of the next annual meeting of the American Society of Heating and Ventilating Engineers The dates tentatively selected are January 25-30, 1926. Arrangements have been made to hold the show in the New Madison Square Garden, 49th to 50th Street and Eighth Avenue, New York, which, it is expected, will be completed in October, 1925.

As the first national exhibition of its kind ever held in this country, the exposition, it is expected, will mark an epoch in the history of the heating and ventilating industry.

The exposition will be under the management of the National Heating and Ventilating Exposition Committee, Suite 334, Hotel McAlpin, New York.

A State Code and Its Preparation

Notes on the Questions and Problems Which Arose in the Development of the Wisconsin Heating and Ventilating Code and Working Rules Supplement and How They Were Handled*

By R. A. Small, Advisory Engineer

Formerly Ventilation Engineer for the Industrial Commission of Wisconsin

THE fundamental function of a State ventilation and heating code is to secure the production and uniform maintenance of atmospheric conditions conducive to health, comfort and welfare in public buildings and places of employment. There are, of course, many kindred effects to be accomplished but the health, safety, comfort and welfare of employees and frequenters are of first importance.

With this in constant view the code should also provide for progress, as well as economy, in methods and apparatus. The science of ventilation and heating is advancing in great strides. What is to-day the acme of arrangement or control may soon be antiquated. The great principles of the art will remain unchanged, if correct, but the manner and combination of arrangement should advance in step with the skill of the artisan. Methods of control have received much attention and have achieved corresponding advancement. Many reliable automatic devices now function with great satisfaction and increased economy where manual control had been thought faulty, perhaps, but indispensable. Code makers should therefore be careful to specify results rather than methods.

METHODS SHOULD BE USED PRINCIPALLY AS ILLUSTRATIONS

Manifestly it is sometimes nearly impossible to avoid method altogether in conveniently describing the results sought, but the method can be used as an illustration, instead of as the objective or even the necessary means to the end. Failure to observe this precaution is apt to make the code hide-bound and to discourage thought and improvement. Moreover, it may lead to inequitable monopoly of manufacture or installation. Many times the method may appear as an explanatory rule or note, so that it is available to show how the requirement may be met, but so the method is eliminated from the mandatory portion of the requirement.

NOT THE FUNCTION OF A STATE CODE TO FOSTER UNWARRANTED EXPERIMENT

The flexibility thus indicated should not be abused. It is not the function of a State code to foster unwarranted experiment at the expense of unwary taxpayers and owners. If the responsible State engineer finds the proposed experimental measures not inimical to the required results, the individual owner should be free to assume responsibility for success and ultimate results. While he is thus free to take a chance on the optimism of the experimenter, he will more often be guided by the unbiased official recommendation.

Unquestionably, the official administration of the code should be thoroughly competent and unbiased. The machinery of administration should be clearly understood by the code makers. References to, or quotations from, extraneous governing authority should be exhibited in regard to hearings and appeals from active official decisions; or, if necessary, provisions for hearing and appeal should be written into the code itself. However, the engineer in direct charge of application and administration of the code should be vested with full authority in the premises. Since the questions involved are usually too technical for governmental department heads, the engineer's decision should generally be considered final. Appeals therefrom should be few and only to avoid any possible personal prejudice. Satisfactorily uniform and effective application of the code depends upon placing final interpretations with the public authority.

IMPORTANCE OF REMOVING CODE FUNCTIONS FROM POLITICAL INFLUENCE

The governmental functions of the department are legislative, executive and judicial, and the department should not be unwieldy in size or action. Legislative power to make and repeal departmental codes should be delegated and prescribed by the legislature, but the formation and composition of the legislature itself are such that it can not formulate or edit an effective, comprehensive code on technical matters. Moreover, code functions should be removed from political spoils influence as far as possible. Ventilation and heating are essentially engineering subjects based on fact and progress, instead of political expediency.

It is difficult to devise a procedure that political spoils cannot sometime subvert, but the Wisconsin code machinery seems well planned. The Industrial Commission is vested with statutory powers to form, revise, repeal and administer code requirements affecting safety and welfare. There are three commissioners, of which one is appointed by each inaugural governor for a term of six years. When important code changes or formulation is found necessary, experts in the different trades and industries affected are appointed to serve without pay as an advisory committee with the commission's engineer. This committee formulates the

*An article dealing with the requirements of the Wisconsin Heating and Ventilation Code appeared in THE HEATING AND VENTILATING MAGAZINE for February, 1924.

code and reports it to the commission for adoption. Public hearings are then held to discuss the proposed code and consider objections, corrections or improvements. If the code is found satisfactory it is then adopted by the commission and published, and after thirty days it has force of statute law.

It is indeed inspiring to see keen business competitors sit side by side in advisory committee meetings and give essentially unbiased opinions based on long practical experience in the particular fields of respective code items. These opinions and suggestions have proven invaluable and the spectacle renews one's faith in men, which is apt to become badly shaken in the daily routine of code administration. The resulting code requirements have been practical, progressive and open, without commercial bias or prejudice. Thus the practising engineer can use any method conducive to consistent results and operation, and any equipment suitable for the service.

VALUE OF A WORKING RULES SUPPLEMENT

It was the suggestion of a practical engineer that illustrative methods, explanatory notes and essential engineering data be compiled into a set of Working Rules to accompany the code, to assist in standardizing both official and private practice. This not only leaves the code free from changing details but enables the department, as well as the profession and trade, to keep up with the times without the ponderous routine of statutory code changes.

In Wisconsin, the code applies to, and is for the use of, not only the professional heating and ventilating engineers, but owners and members of other professions and trades more or less unskilled in the technical features of this engineering field. The Working Rules proposed to, and adopted by, the commission, along with certain code revisions after a year's experience with the initial code, comprise a supplement somewhat more extensive than the code itself but therein are cleared away the most frequent popular questions and difficulties observed. The Working Rules are not indexed but are interspersed with the particular code items to which they respectively apply.

VENTILATION AND FRESH AIR

Much has been said about ventilation and fresh air being unnecessary. Attempts have been made to prove that stale air is just as comfortable and healthful as fresh air. In the most widely-quoted experiments, however, it should be borne in mind that the subjects did not report their feelings while in the stale air but after they had emerged into fresh air, and, of course, they felt refreshed and vigorous. The human body possesses a ruggedness and recuperative power that permits one to undergo emergency privations without apparent injury, and yet one would not think of prolonging those privations under avoidable duress. If fresh air and ventilation are of no importance, and if the office, store and theater stale air cesspools are healthful, whence cometh the demand for drug-store complexions that vainly try to emulate the bloom of health that comes naturally with fresh air?

Man is naturally an out-door animal and the more time he spends indoors the more necessary it is that the buildings be ventilated. As a schoolboy I was out-doors before school, after school and at recess. In the evening I was skating or coasting. I could sit by the stuffy school stove and sizzle on one side at a time without visible impairment of health, but these days of interior gymnasiums, enclosed cars and movies, when the teacher has to insist in order to get the children out into bright sunshine at recess, are different.

FUTILITY OF OPEN WINDOW VENTILATION

Subterfuges have been evolved for hypothetical ventilation without fresh air. It has been suggested that the classroom be made into a sort of stagnant cesspool from which the atmospheric scum would be skimmed off in limited quantities at the ceiling. Again, window ventilation is advocated by many who should know better. It is perhaps a conveniently simple method in mild weather but is worse than useless in severe winter weather like ours. When it is so hard to keep the fresh air intake open it is folly to expect the same parties to open the windows in the classroom; and if they did, wherein is the economy? It takes so much heat to raise the temperature of so much air so many degrees, whether the work is done alongside the shivering student or down at the heater where it belongs. No, the real appeal, if not the incentive, is in the ease of shutting off the fresh air and expense.

The amount of air movement necessary to preserve a given standard of purity and bodily service depends upon the method and uniformity of distribution and disposal, but it is usually cheaper to handle a relatively large volume of air than to provide more intricate facilities for distribution.

ROOMS SHOULD BE FLOODED WITH AIR

The importance of air movement in contact with the human body is becoming more generally recognized and it is a well-established principle of successful warm-air heating that the room should be flooded with air. Since circulation for ventilation purposes depends largely upon the same principles of air density used in warm-air heating, an arrangement that will heat a room will also generally ventilate it, but no particular arrangement should be made a part of the mandatory requirement that the distribution of air flow in an occupied room be made uniform. For the code being considered there are nearly a dozen items pertaining to the arrangement of inlets and outlets in the Working Rules which determine standard practice, but the code itself reads simply: "The capacity, number and arrangement of inlets and outlets shall be such as to

insure a positive and adequately uniform distribution of air throughout the occupied areas served during all periods of occupancy, and to accomplish the desired intimate contact with the body of each occupant."

BASIS OF WISCONSIN CODE AIR FLOW QUANTITIES

Air-flow quantities stipulated are somewhat conventional and necessarily arbitrary. Recognizing the habits of the profession they are expressed in terms of cubic feet per minute per square foot of floor area. The extent of floor generally determines the amount of occupancy and the classification of area assists in determining the intensity of occupancy. Therefore the "C.F.M.-per-sq.ft.." terminology saves a multitude of occupancy calculations and attendant haggling. Many a neat, beautiful, commodious structure has been presented for approval with the bland statement that the building will hardly ever be occupied and even then by a mere fraction of the arranged capacity, and the owners become desperately poor as soon as ventilation is mentioned. As a matter of fact, the Wisconsin code ventilation air-flow quantities are based on 30 C.F.M. per person for schools, 18 C.F.M. for theaters and only 6 C.F.M. for churches.

RELATIVE HUMIDITY STANDARDS

Due to climatic conditions a high relative humidity would cause excessive frosting of windows and sweating of walls, so 40% was established as the minimum relative humidity. Outside air at 20° F. below zero may be considered dry, and the heat load of evaporating enough water for 40% humidity at 70° becomes the considerable item of 30 B.T.U. per C.F.M., or 125 sq. ft. E.D.R. per 1000 C.F.M.

For water pan humidifiers it is difficult to control the relative humidity if the air is used for heating purposes. The rate of evaporation depends upon the direction and intensity of air impingement on the water and the temperature of both air and water. In the absence of accurate data the minimum evaporative surface for a plain water pan was set at 200 sq. in. per 1000 C.F.M. and the pan is required to be located in the heat chamber where it will affect all the air flow. Accelerating coils serve to reduce the necessary amount of evaporative surface.

METHOD AND CONTROL CHIEF STUMBLING BLOCKS

Method and control have been chief stumbling blocks. Manual methods and control are inaccurate and uncertain unless consistent operation thereof appeals to natural impulse or means less work for the operator or less expense for the owner and employer. Few will deny the benefit and increased safety of guards on mechanical apparatus, but experience shows that if an optional guard adds so much as one little motion or effort to a production operation the guard falls into habitual disuse, even under skilled shop discipline. Many were the railroad wrecks when trains crossed intersections at the discretion of individual trainmen. Accidents were reduced when a neutral signalman controlled the traffic, but the only safe way yet devised is to fool-proof the crossing by automatically de-railing one track in order to clear the other.

SAFE CONTROL OF VENTILATION APPARATUS ESSENTIAL

It is time ventilation authorities were learning the object lesson in safe control. Vast sums have been spent for ventilation apparatus that has scarcely turned a wheel since final payment. I speak particularly of the high per cent split system that is as inherently perfect-and-yet-imperfect as the unprotected railroad intersection. The railroad engineers saved time and brakes by not taking the crossing precautions too seriously, and the janitor engineers save coal and labor by not running the fans. The problem is, therefore, to put a "de-rail" in ventilation control, and the colder the climate the more thoroughly should the job be fool-proofed.

The answer here, as well as for machine guards, is to fix the installation so it cannot be operated otherwise or else make the proper control a matter of natural impulse. Where complaints arose because of faulty ventilation, the one condition always found was that the room or rooms could be heated without being ventilated. Ventilation requires labor and hard cash for a benefit that is often as intangible as waiting for a train that is not yet seen. The human body is rugged in many ways but very sensitive to temperature changes. There are only a few degrees difference in body temperature between the well man and the sick man. Here, then, is our cue,—make ventilation resultant from, and coincident with, keeping warm.

MODIFICATION OF SPLIT SYSTEM ONE SOLUTION OF THE PROBLEM

This does not mean the elimination of the split system, but it does mean a rational modification of the split system as it has grown to be in cold climates. There are many situations in which independent heat service is not only convenient but necessary. Advantage given to protected ventilation systems will increase the use of them and their ventilation, so the protection may well be linked with economy of operation. Since a consistently-ventilated room requires less outside air supply to maintain standard purity than a similar room indifferently or spasmodically ventilated, it follows that the protected ventilation system may safely recirculate a fraction of the air-flow volume. This brings immediate favor at the coal pile.

FRACTIONAL AIR RECIRCULATION ADVOCATED

The Wisconsin answer in the dilemma is partly educational and partly mandatory. If the room

(*Continued on page* 71)

Calculating Radiation Requirements of Residences

How the Willard and Lichty Heat Transmission Formula May Be Applied To A Variety of Building Constructions In Common Use

COMPUTATIONS of heat losses through different types of building materials in common use are always interesting, if only for checking purposes. This is especially true if they are figured from one of the better-known formulas.

The calculations here shown are taken from a new manual compiled by the Flax-li-num Insulating Co., St. Paul, Minn., and are supplemented, in the manual, by tables showing how savings in the radiation required and in the amount of fuel burned are obtained through the use of insulating building materials.

All of the calculations are based on three formulas developed by Messrs. Willard and Lichty, as published in the University of Illinois Bulletin No. 102:

1. Heat transmission through simple wall:

$$K = \frac{1}{\frac{1}{S_o} + \frac{T}{C} + \frac{1}{S_i}}$$

2. Heat transmission through wall of more than one material, but without air spaces:

$$K = \frac{1}{\frac{1}{S_o} + \frac{T}{C_1} + \frac{T}{C_2} + \frac{T}{C_3} + \frac{1}{S_i}}$$

3. Heat transmission through wall made up of various materials and containing air spaces:

$$K = \frac{1}{\frac{1}{S_o} + \frac{T}{C_1} + \frac{1}{S_2} + \frac{T}{C_2} + \frac{T}{C_3} + \frac{1}{S_3} + \frac{1}{S_4} + \frac{T}{C_4} + \frac{1}{S_i}}$$

$$K = \frac{1}{\frac{1}{4.2} + \frac{4}{5} + \frac{1}{1.4} + \frac{0.02}{0.4} + \frac{0.75}{1.2} + \frac{1}{1.4} + \frac{1}{1.3} + \frac{0.75}{8.3} + \frac{1}{1.3}}$$

$$K = \frac{1}{4.718} = 0.212$$

This figure (0.212) gives us the amount of heat in B.T.U. transmitted through 1 sq. ft. of brick veneer wall shown above for every degree difference between the outside and inside temperature for every hour of time.

K = heat transmission coefficient of wall desired in B.T.U. per sq. ft. per deg. F. per hour.

C = coefficient of material making up wall per inch in B.T.U. per sq. ft. per deg. F. per hour.

S_1 = inside surface coefficient of material making up wall in B.T.U. per sq. ft. per deg. F. per hour.

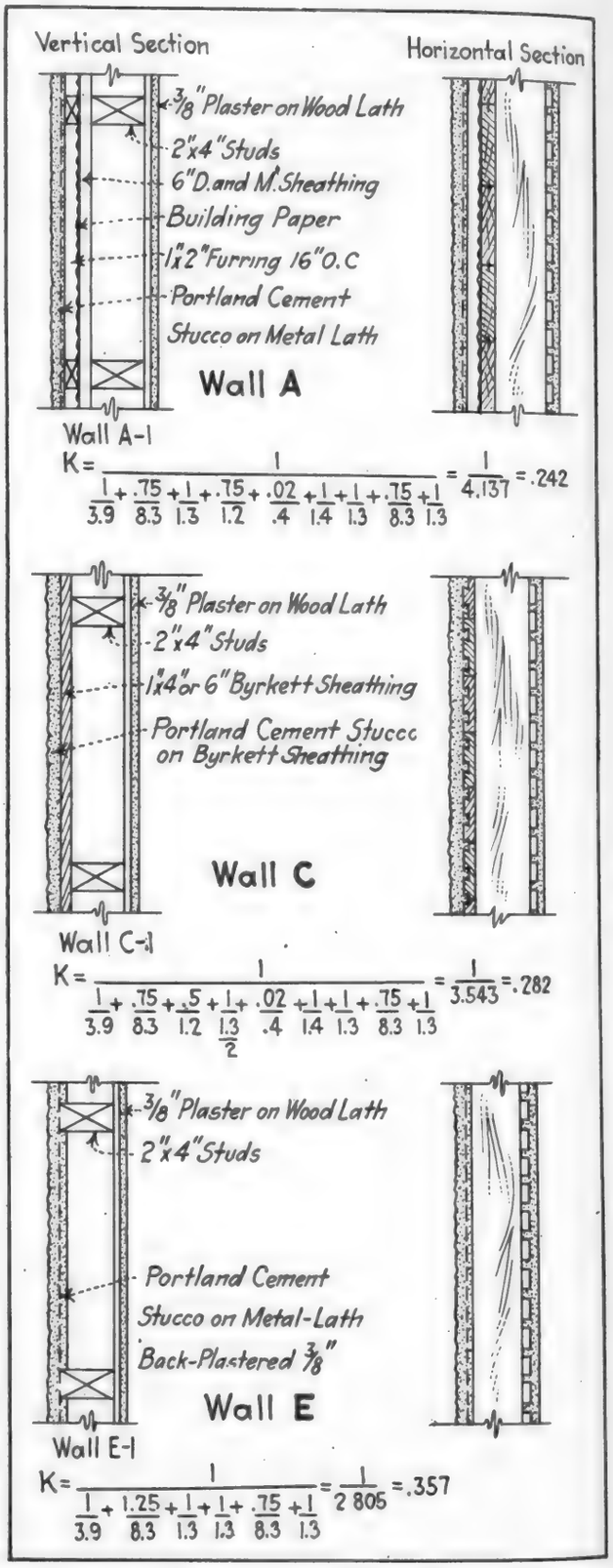
Vertical Section
Horizontal Section
3/8" Plaster on Wood Lath
2"x4" Studs
6" D. and M. Sheathing
Building Paper
1"x2" Furring 16" O.C
Portland Cement
Stucco on Metal Lath
Wall A
Wall A-1
K = 1 / (1/3.9 + .75/8.3 + 1/1.3 + .75/1.2 + .02/.4 + 1/1.4 + 1/1.3 + .75/8.3 + 1/1.3) = 1/4.137 = .242
3/8" Plaster on Wood Lath
2"x4" Studs
1"x4" or 6" Byrkett Sheathing
Portland Cement Stucco on Byrkett Sheathing
Wall C
Wall C-1
K = 1 / (1/3.9 + .75/8.3 + .5/1.2 + 1/(1.3/2) + .02/.4 + 1/1.4 + 1/1.3 + .75/8.3 + 1/1.3) = 1/3.543 = .282
3/8" Plaster on Wood Lath
2"x4" Studs
Portland Cement
Stucco on Metal-Lath
Back-Plastered 3/8"
Wall E
Wall E-1
K = 1 / (1/3.9 + 1.25/8.3 + 1/1.3 + 1/1.3 + .75/8.3 + 1/1.3) = 1/2.805 = .357

Fig. 1. Heat Transmission of Walls. No. 1—Stucco Walls

Heat Transmission of Walls

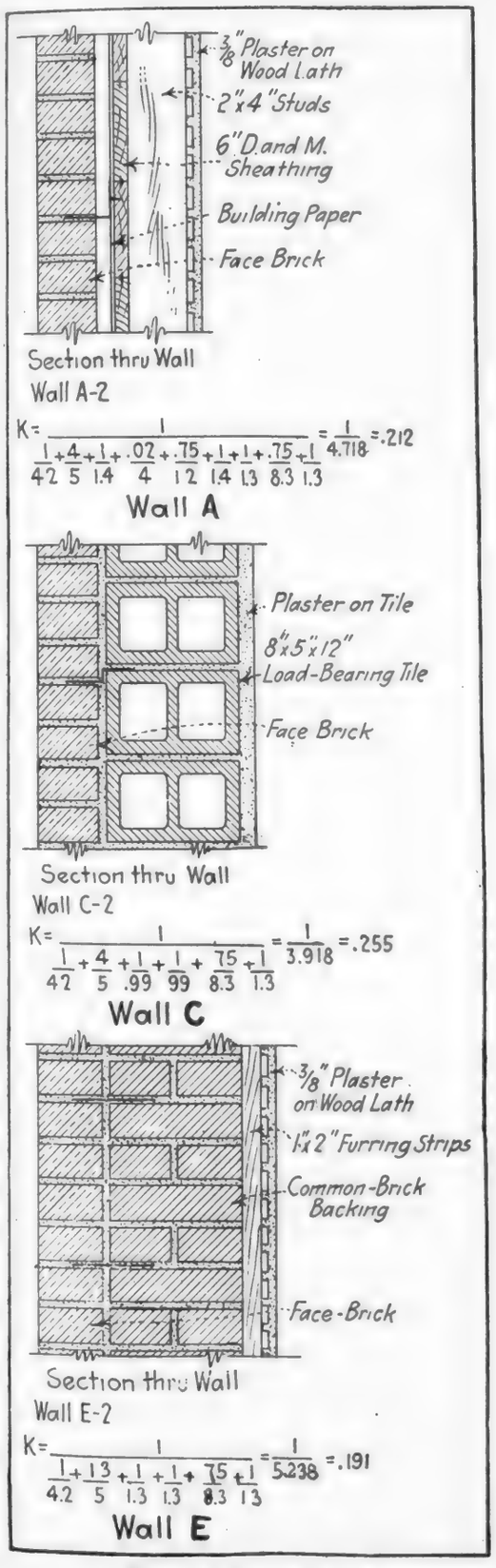
3/8" Plaster on Wood Lath
2"x4" Studs
6" D. and M. Sheathing
Building Paper
Face Brick
Section thru Wall
Wall A-2
K = 1 / (1/4.2 + 4/5 + 1/1.4 + .02/4 + .75/1.2 + 1/1.4 + 1/1.3 + .75/8.3 + 1/1.3) = 1/4.718 = .212
Wall A
Plaster on Tile
8"x5"x12" Load-Bearing Tile
Face Brick
Section thru Wall
Wall C-2
K = 1 / (1/4.2 + 4/5 + 1/.99 + 1/99 + .75/8.3 + 1/1.3) = 1/3.918 = .255
Wall C
3/8" Plaster on Wood Lath
1"x2" Furring Strips
Common-Brick Backing
Face-Brick
Section thru Wall
Wall E-2
K = 1 / (1/4.2 + 1.3/5 + 1/1.3 + 1/1.3 + .75/8.3 + 1/1.3) = 1/5.238 = .191
Wall E

Fig. 2. Brick Walls

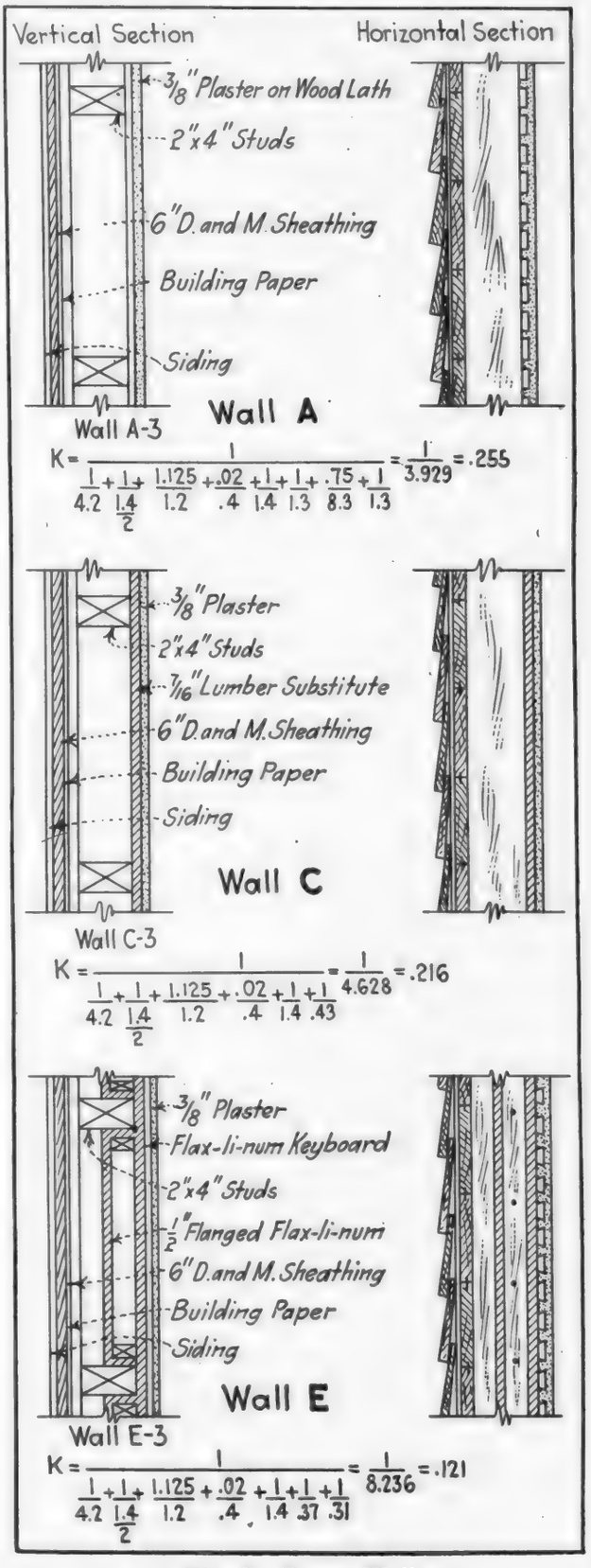
Vertical Section
Horizontal Section
3/8" Plaster on Wood Lath
2"x4" Studs
6" D. and M. Sheathing
Building Paper
Siding
Wall A-3
Wall A
K = 1 / (1/4.2 + 1/(1.4/2) + 1.125/1.2 + .02/.4 + 1/1.4 + 1/1.3 + .75/8.3 + 1/1.3) = 1/3.929 = .255
3/8" Plaster
2"x4" Studs
7/16" Lumber Substitute
6" D. and M. Sheathing
Building Paper
Siding
Wall C-3
Wall C
K = 1 / (1/4.2 + 1/(1.4/2) + 1.125/1.2 + .02/.4 + 1/1.4 + 1/.43) = 1/4.628 = .216
3/8" Plaster
Flax-li-num Keyboard
2"x4" Studs
1/2" Flanged Flax-li-num
6" D. and M. Sheathing
Building Paper
Siding
Wall E-3
Wall E
K = 1 / (1/4.2 + 1/(1.4/2) + 1.125/1.2 + .02/.4 + 1/1.4 + 1/.37 + 1/.31) = 1/8.236 = .121

Fig. 3. Frame Walls

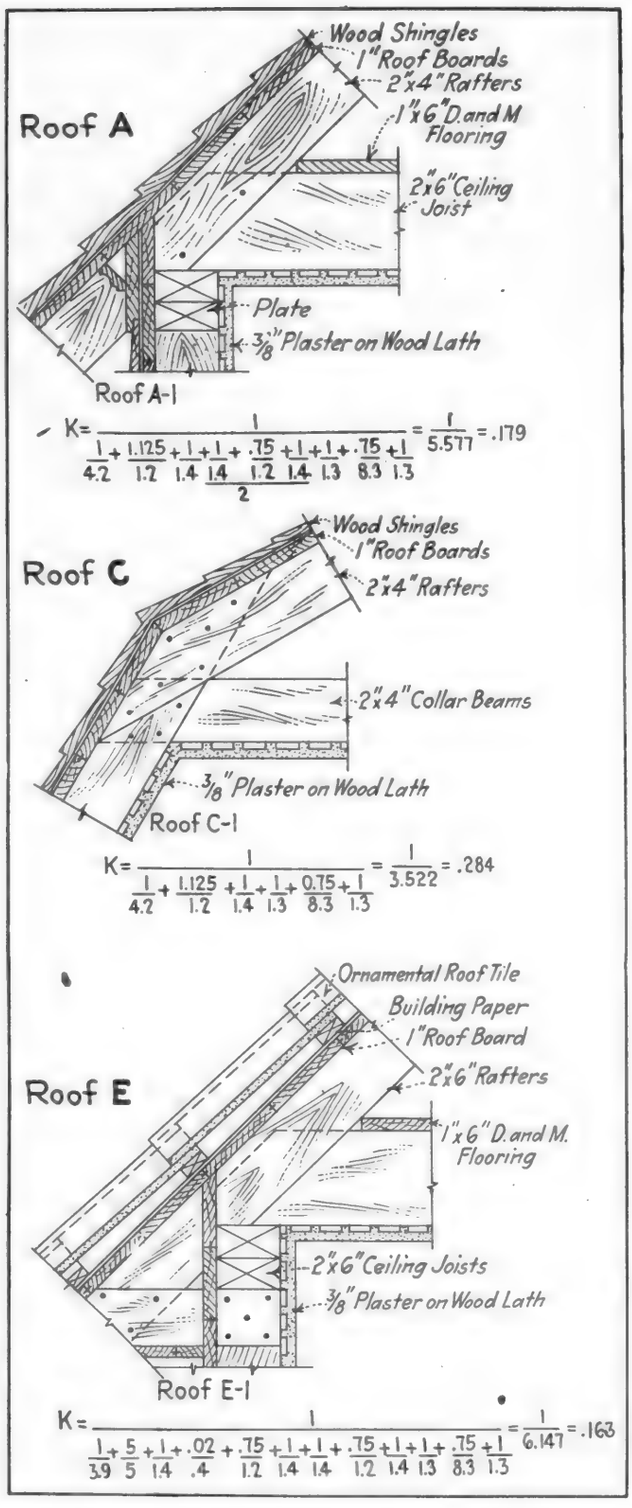
Roof A
Wood Shingles
1" Roof Boards
2"x4" Rafters
1"x6" D. and M Flooring
2"x6" Ceiling Joist
Plate
3/8" Plaster on Wood Lath
Roof A-1
K= 1 / (1/4.2 + 1.125/1.2 + 1/1.4 + 1/1.4 + .75/1.2 + 1/1.4 + 1/1.3 + .75/8.3 + 1/1.3) / 2 = 1/5.577 = .179
Roof C
Wood Shingles
1" Roof Boards
2"x4" Rafters
2"x4" Collar Beams
3/8" Plaster on Wood Lath
Roof C-1
K= 1 / (1/4.2 + 1.125/1.2 + 1/1.4 + 1/1.3 + 0.75/8.3 + 1/1.3) = 1/3.522 = .284
Roof E
Ornamental Roof Tile
Building Paper
1" Roof Board
2"x6" Rafters
1"x6" D. and M. Flooring
2"x6" Ceiling Joists
3/8" Plaster on Wood Lath
Roof E-1
K= 1 / (1/3.9 + 5/5 + 1/1.4 + .02/.4 + .75/1.2 + 1/1.4 + 1/1.4 + .75/1.2 + 1/1.4 + 1/1.3 + .75/8.3 + 1/1.3) = 1/6.147 = .163

Fig. 4. Heat Transmission of Roofs

S_o = outside surface coefficient of material making wall in B.T.U. per sq. ft. per deg. F. per hour.

T = thickness in inches.

The factors S_0, S_1, S_2, S_3, S_4 and C_1, C_2, C_3, etc., are known from tabulations of tests and experiments.

APPLYING HEAT LOSS FORMULAS TO HOUSE ROOFS

As the manual points out, the same formula used to determine heat losses through walls may of course be applied to house roofs. For generations the popular method of determining this loss was to assume an average winter temperature in the attic or loft, and then consider only the transmission from the upstairs rooms to the attic.

This attic temperature, for instance, was often taken at 40°, where the average temperature outside was being taken as 28° or less. The fact that there was a constant heat loss from the attic which varied with the construction of the roof above was entirely overlooked.

Heat passes from upstairs rooms into the attic, and from the attic to the out-of-doors. The attic forms an open space which adds two surface resistances to the total heat resistance of the roof and ceiling combination. Considering this combination as a compound wall eliminates an old error, and brings computed heat losses nearer the actual. This method is followed by Professor Frank B. Rowley in his bulletin, "Transmission of Heat Through Building Materials," published under date of October 26, 1923, by the University of Minnesota.

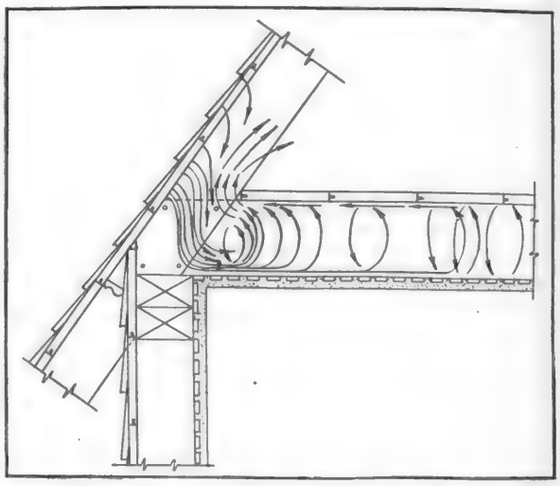

Fig. 5. Trend of Air and Heat Flow at Eave Line When Attic Floor is Used

The formulas here given accurately gauge all heat losses that occur by conduction in straight lines through the ceiling and roof. They are correct without adjustment so long as there is no variation in construction at the eave line. However, where an attic floor is used, as in ceilings A-4, and E-4, a sizable heat loss occurs from the ceiling into the attic which does not go through this floor, but travels around it by convection and up through the open spaces between the rafters, which are not as a rule covered by the attic floor. Fig. 5 shows the manner of this heat flow.

In computing the heat loss from celings where this construction is in use, states the manual, it is safe to assume the heat resistive qualities of the floor (not any other part of the roof and ceiling combination) cut in two for a distance of 8 ft. out from the walls.

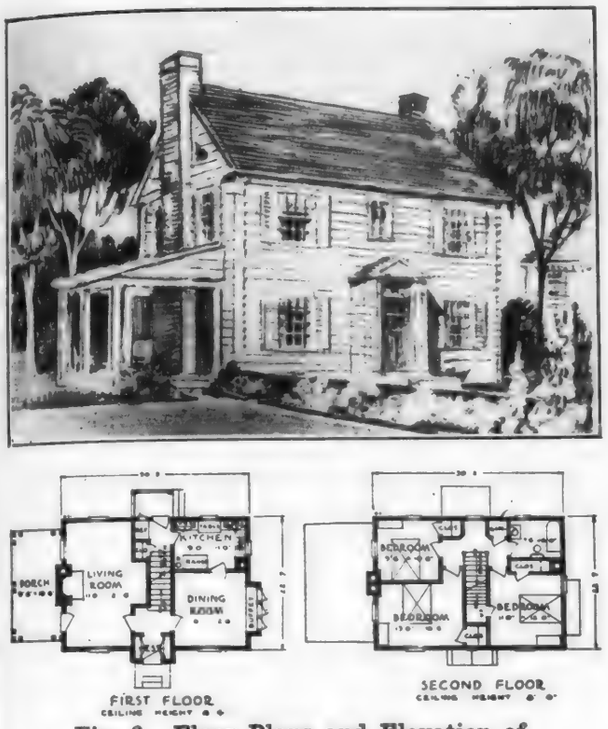

Fig. 6. Floor Plans and Elevation of Two-Story House
(Architect's Small House Heating Bureau Home Plan No. 6A17)

The formula for this 8-ft. strip, therefore, becomes:

$$K = \frac{1}{\frac{1}{4.2} + \frac{1}{1.2}\,125 + \frac{1}{1.4} + \frac{1}{1.4} + \frac{0.75}{1.2} + \frac{1}{1.4} + \frac{1}{1.3} + \frac{0.75}{8.3} + \frac{1}{1.3}}$$

$$K = \frac{1}{4.544} = 0.220$$

The heat loss from the roof of the house illustrated in Fig. 6 is computed on this basis.

In the accompanying illustrations (Figs. 6 and 7) are shown two houses with the total heat losses and coal consumed computed on the basis of average temperature difference for the northern half of the United States.

The heat transmission used for walls and roofs are those shown on the charts, the derivation of which has been given. The houses were assumed to have double sash which has a heat transmission of 0.45 B.T.U.

Value of water radiation taken is 150 B.T.U. per square foot. Maximum heat loss to determine size of radiators and of necessary heating plant is computed with inside temperature of 70° F. and outside of –20° F.

The heating season is taken at 210 days, with an average temperature of 28°F. (United States Weather Bureau reports) over this period.

TABLE 1. RADIATION AND FUEL SAVINGS ON A HOUSE
(Architect's Small House Service Bureau Plan No. 6A17).

W = 1,872 sq. ft. wall surface.
G = 211 sq. ft. glass surface.
C = 176 sq. ft. at roof constant.
C = 484 sq. ft. at eave line constant.
V = 11,880 cu. ft. volume.

H = Total heat in B.T.U.
W = Wall surface in square feet
G = Glass surface in square feet
C = Ceiling surface in square feet
V = Volume of air in cubic feet
N = Air infiltration changes per hour
T = Room temperature
T_o = Outside temperature
K_w = Heat transmission constant for wall
K_g = Heat transmission constant for glass
H_w = Heat in B.T.U. transmitted through wall per hour or $K_wW\ (T_1 - T_o)$
H_g = Heat in B.T.U. transmitted through glass per hour or $K_gG\ (T_1 - T_o)$
H_a = Heat in B.T.U. lost by infiltration per hour or $.02VN\ (T_1 - T_o)$
H_c = Heat in B.T.U. transmitted through ceiling per hour or $H - H_w - H_g - H_a - H_c$

	Stucco Finished Wall No.			Brick Finished Wall No.			Siding Finished Wall No.		
	A-1	C-1	E-1	A-2	C-2	E-2	A-3	C-3	E-3
K_w	0.242	0.282	0.357	0.212	0.255	0.191	0.255	0.216	0.121
K_g	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
K_c	0.179	0.179	0.179	0.179	0.179	0.179	0.179	0.179	0.104
K_{c1}	0.220	0.220	0.220	0.220	0.220	0.220	0.220	0.220	0.220
H_w	40,772	47,511	60,147	35,718	42,962	32,179	42,962	36,391	20,386
H_g	11,785	11,785	11,785	11,785	11,785	11,785	11,785	11,785	11,785
H_c	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835
H_{c1}	9,583	9,583	9,583	9,583	9,583	9,583	9,583	9,583	5,053
H_v	21,384	21,384	21,384	21,384	21,384	21,384	21,384	21,384	21,384
Total	86,359	93,098	105,734	81,305	88,549	77,766	88,549	81,987	60,255
10% for exposure	8,836	9,309	10,573	8,130	8,855	7,777	8,855	8,198	6,026
Total loss per hour	94,995	102,407	116,307	89,935	97,404	85,543	97,409	90,176	66,281
Total radiation required	663	683	775	596	649	570	649	601	442
Coal in tons per season	10.7	11.5	12.7	9.7	10.7	9.4	10.6	10.1	7.3

TABLE 2. REQUIRED RADIATION AND FUEL CONSUMPTION IN A HOUSE WITH DIFFERENT TYPES OF WALL AND ROOFS (SHOWN IN FIG. 6)

(Architects' Small House Service Bureau Plan No. 6A17)

Wall No.	Value of K	Radiation Required	Tons of Coal per Season
A-1	0.242	633	10.7
C-1	0.282	683	11.3
E-1	0.357	775	12.7
F-1*	0.211	595	9.7
A-2	0.212	596	9.7
C-2	0.255	649	10.7
E-2	0.191	570	9.4
A-3	0.255	649	10.6
C-3	0.216	601	10.1
D-3**	0.226	613	10.2
Average	0.246	636	10.5

* Insulated with ½-in. flanged Flaxlinum.
** Insulated with ½-in. Flaxlinum.

Heat loss due to infiltration will in actual practice vary, depending upon the wall construction. Caulking around windows, well-fitted insulation, beam fills and storm sash all cut down air infiltration. Houses insulated with a material placed between the studding let through less air than if no material were in place. This is a variable factor upon which there are no definite data, and, therefore, all infiltrations are considered to be equal. Infiltration is taken as $N = 1$. That is, one complete air change takes place in the house every hour.

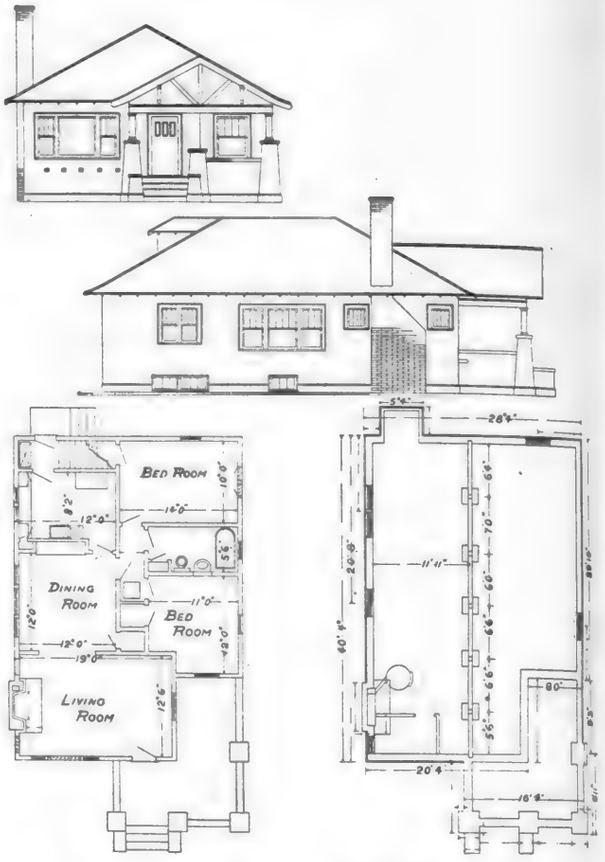

Fig. 7. Floor Plans and Elevation of Typical One-Story Bungalow

FIGURES FOR ONE-STORY BUNGALOW

One of the most common of the high heat-loss types of houses is the one-story bungalow and its modification, the story-and-a-half house. In this class may be included all houses with relatively large roof areas and without attic floors and finished rooms above the regular heating quarters. This includes a great many houses of the Dutch Colonial type and most houses of the smaller English cottage type.

TABLE 3. RADIATION AND FUEL COSTS FOR ONE-STORY BUNGALOW

$W = 1{,}005$ sq. ft. wall surface.
$G = 162$ sq. ft. glass surface.
$C = 1{,}060$ sq. ft. of ceiling surface.
$V = 9{,}010$ cu. ft. volume.

	Stucco Finished Wall Number			Brick Finished Wall Number			Siding Finished Wall Number		
	A-1	C-1	E-1	A-2	C-2	E-2	A-3	C-3	E-3
K_w	.242	.282	.357	.212	.255	.191	.255	.216	.121
K_g	.45	.45	.45	.45	.45	.45	.45	.45	.45
K_c	.284	.284	.284	.284	.284	.284	.284	.284	.132
H_w	21,889	25,507	32,291	19,175	23,065	17,276	23,065	19,537	10,944
H_g	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561
H_c	27,093	27,093	27,093	27,093	27,093	27,093	27,093	27,093	12,593
H_v	16,218	16,218	16,218	16,218	16,218	16,218	16,218	16,218	16,218
Total	71,761	74,379	82,163	69,047	72,937	67,148	72,937	69,409	46,316
10% for exp.	7,176	7,438	8,216	6,905	7,294	6,715	7,294	6,941	4,632
Total loss per hour	78,937	82,817	90,379	75,932	80,231	73,963	80,231	76,359	50,948
Total rad. req.	526	552	603	506	535	493	835	509	340
Coal in tons per season	8.1	8.5	9.2	7.7	8.2	7.5	8.2	7.8	5.2

TABLE 4. REQUIRED RADIATION AND FUEL CONSUMPTION IN ONE-STORY BUNGALOW WITH DIFFERENT TYPES OF WALLS AND ROOFS

Wall No.	Value of K	Radiation Required	Tons of Coal per Season
A-1	0.242	526	8.1
C-1	0.282	552	8.5
E-1	0.357	605	9.2
F-1*	0.211	506	7.7
A-2	0.212	506	7.7
C-2	0.255	535	8.2
E-2	0.191	493	7.5
A-3	0.255	535	8.2
C-3	0.216	509	7.8
D-3**	0.226	516	7.9
F-3***	0.170	478	7.3
Average	0.237	523	8.01

* Insulated with Flaxlinum keyboard and Portland cement stucco on Flaxlinum keyboard.
** Insulated with 7/16-in. lumber substitute.
*** Insulated with ½-in. Flaxlinum.

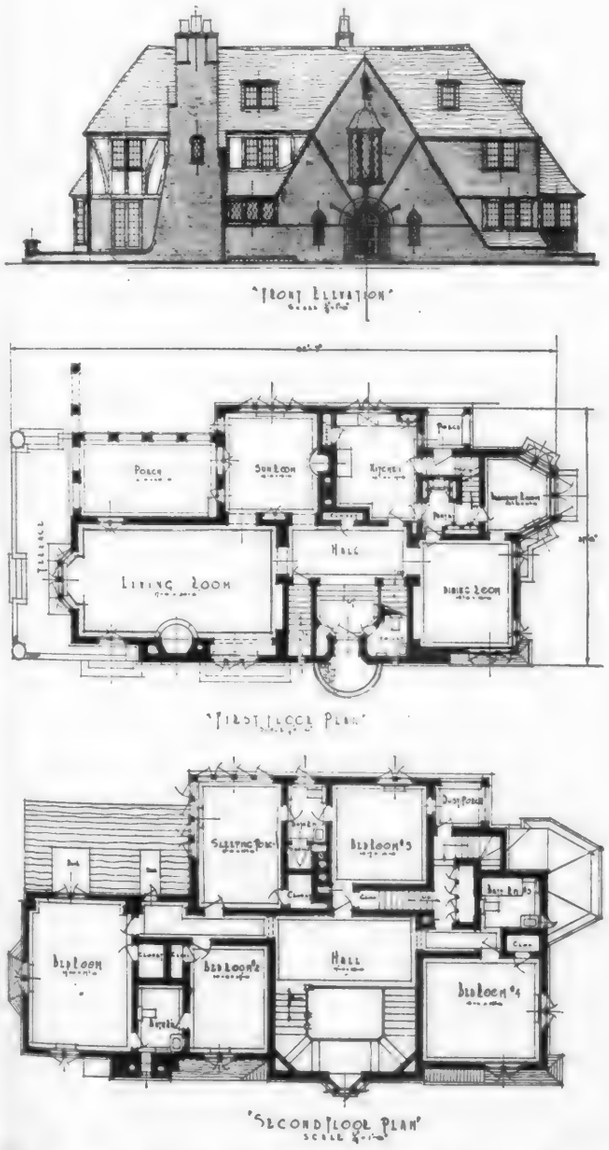

Fig. 8. Floor Plans and Elevation of a Larger House

One reason for the high heat losses in this type of house lies in the construction of the roof and ceiling.

Where the roof and ceiling combination of the two-story house, including the attic floor, without heat insulation is 0.179 B.T.U. the roof of the one-story and Dutch Colonial types is 0.284 B.T.U.

The relation between these two roof types is as follows: Difference in heat transmission through roof of bungalow and two-story house. $= \frac{0.284 - 0.179}{0.284} = 37\%$

This percentage is somewhat reduced by the correction made on the two-story type for convection around the attic floor at the eave line. In a great many houses much of the benefit of the attic floor is dissipated by poor construction at that point.

The one-story bungalow here shown (Fig. 7) is figured in the same way as the two-story house. Like the two-story type this home is shown with all applicable wall and roof constructions.

TABLE 5. REQUIRED RADIATION AND FUEL CONSUMPTION IN A LARGER HOUSE

W = 3,135 sq. ft. wall surface.
G = 598 sq. ft. glass surface.
C = 2,637 sq. ft. ceiling surface.
V = 36,080 cu. ft. volume.

	Wall No. A–2 Ceiling No. C–4
K_w	0.212
K_c	0.284
K_g	0.45
H_w	59,816
H_c	67,402
H_g	24,219
H_v	64,944
Total	216,381
10% for exposure	21,638
Maximum loss per hour	238,019
Total rad. req. water	1,587
Total rad. req. vapor	993
Coal in tons per season	25.9

(Note: To simplify computations all walls have been taken as brick veneer, although small parts of the top story are actually stucco and half timber.)

A State Code and Its Preparation

(*Continued from Page* 65)

must be ventilated in order to be warmed, half the air supply may be recirculated; but if there is present more than 40% enough direct radiation to furnish the required heat service, no recirculation may be practised at any time. There are yet, and doubtless will continue to be, a few high per cent. split systems provided for schools and other public buildings and paid for more or less cheerfully by tax-burdened owners, but apparently the pendulum of preferred practice has already swung toward protected ventilation and fractional recirculation.

(*To be Continued in April Issue*)

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WHAT are we to do with our obsolete compulsory ventilation laws? This question is suggested by the recent study by John Rankin McLure, Ph. D. on "The Ventilation of School Buildings," which has just made its appearance and which calls renewed attention to a situation all too well-known in heating and ventilating circles. As Dr. McLure states, practically all of the compulsory ventilation laws on the statute books, with the exception of the Wisconsin code and possibly one or two others, were put there originally at the instance of the heating and ventilating industry. The American Society of Heating and Ventilating Engineers has taken the responsibility or has acted as sponsor for many of them. At the time they were enacted there was no diversity of opinion among professional men as to their adequacy. In fact, the need then was felt to be not so much a broadening of the requirements as their stricter and wider application. Uniformity was urged and it was in direct response to this need that the heating engineers' society, in 1915, adopted its well-known "Minimum Code."

Then, as if by magic, the situation changed. We recall very distinctly the firing of the opening gun of the new dispensation when the late Dr. Luther Gulick made his sensational address at one of the society's meetings on the fallacy of the CO_2 air test. From that moment the industry appeared to gain a new conception of the effects of excessive carbon dioxide which, of course, was the basis of all the compulsory ventilation laws enacted up to that time. Advocates of "recirculation" came into the picture and before we knew it, we were talking about recirculation with and without ozone and air washers, or both, as if we had never heard of the CO_2 theory.

It was not until the jolt of the American Engineering Standards Committee's action in turning down the "Minimum Code" as a basis for a national code that the industry woke up to the fact that it needed a new code more in conformity with the results of modern research. Accordingly the heating engineers' society inaugurated the compilation of a new code which is now being so widely discussed in its tentative form.

But the query remains, what are we to do with the compulsory ventilation laws now on the statute books? Are we to wait for the new code to be perfected and then offer it as a substitute for the present laws on this subject? The matter is one that is crying to Heaven for attention and, so far as the record goes, the laws now in effect are the expression of the industry's convictions on this matter.

SERIOUS as this situation is in itself, it gains added significance when a study comes out like that of Dr. McLure's, in which the practices embodied in these laws are held up to derision and the requirements considered as if they were an expression of the views still held by a large section of the industry.

This is what hurts, because, as we all know, the industry would not think of advocating such requirements as are contained in most of our State ventilation laws. We believe those whom the laws most affect should be set straight upon this important matter by the responsible elements in the industry, rather than by outsiders.

IT IS a pity that such a thoughtful and painstaking analysis of the science of ventilation and of the development of modern ventilating methods should lead the author to the conclusion that the open window, after all, offers the most promising solution of the problem. Admitting, for the sake of argument, the main premises laid down by Dr. McLure, his conclusions are manifestly open to the same line of attack as that he directs at mechanical ventilation, for the reason that the science is still admittedly in the process of evolution and it is a rash man indeed who will put himself on record as to just what the ventilation practice of the future is to be. We dare say that in the years to come the arguments for open-window ventilation will appear as grotesque as those used years ago in favor of mechanical ventilation—and on the same grounds of inadequacy and ineffectiveness. At the same time, the industry is indebted to Dr. McLure for the first comprehensive study which has ever been made of the actual status of mechanical ventilation, including present standards and practices, based upon a collection of data covering some 700 school buildings throughout the United States, equipped with various types of systems, and for his equally comprehensive data on actual costs of installation of heating and ventilating systems. Here he is on firm ground and the facts he presents are those which every heating man needs to know.

"The Mistakes of Moses" Applied to the Science of Ventilation

IF ROBERT G. INGERSOLL had been a ventilating engineer, instead of a nationally-known agnostic, he could scarcely have penned a more withering criticism of the practice of mechanical ventilation, as commonly applied to school buildings, than is contained in John Rankin McLure's "The Ventilation of School Buildings; A Study of Present Practices and Costs in the Light of Experimental Research," which has just been published by Teachers College, Columbia University, New York (Contributions to Education, No. 157). This work by the way, prepared as a thesis, won for Dr. McLure his degree of Doctor of Philosophy from Columbia University.

What gives the study its greatest practical value to the ventilating engineer is the basis upon which the author draws some of his most important conclusions. This basis is the result of a questionnaire involving essential details of heating and ventilating which he sent out to all cities having a population of 30,000 or more. The information obtained included data on heating and ventilating systems installed in all new school buildings contracted for since January 1, 1918. Another section takes up the extent to which ventilating systems are being operated. A third section contains these data, in much greater detail, for a representative new school building, contracted for in each city since January 1, 1920.

The replies to the questionnaire, together with a review of the existing literature on the general subject of mechanical ventilation, leads Dr. McLure to the following conclusions and summary with which he closes his study:

ENDORSES WINDOW VENTILATION

"A generally-recognized standard for schoolroom ventilation has been, for many years, that of 30 cu. ft. of fresh air per minute per pupil. This standard is embodied in the laws of 21 states, being found in the statutes of 9 states and in board regulations having the force of law in the other 12 states.

"This study of 700 new school buildings in 96 cities of 31 states shows conclusively that the installation of mechanical or fan ventilation is the established practice in the great majority of these cities.

"The theory upon which mechanical ventilation is based is, mainly, that the health and comfort of pupils demand the constant and uniform movement of large quantities of fresh air through the room. The amount of air needed was originally considered by leading advocates to be 50 cu. ft. per minute, but for several decades 30 cu. ft. has been designated as the desirable amount.

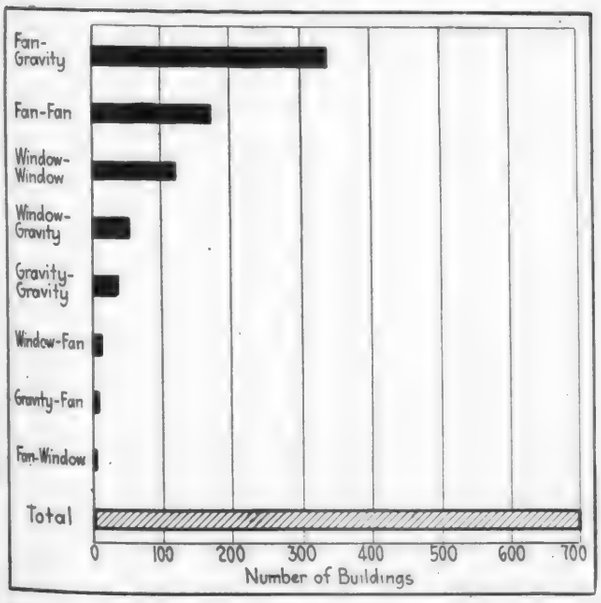
"Experimental research over several decades has failed to confirm the theory that expired air, in rooms ordinarily occupied, contains poisonous or injurious substances or that it is the cause of the discomfort usually experienced in such rooms. It has been shown repeatedly that the factors of major importance in ventilation are the physical properties of air, namely, temperature, relative humidity, and air movement. The results of research, reviewed in this study, show that temperature is the most important factor in ventilation and that the overheating of rooms—not the chemical composition of expired air—is the usual cause of discomfort and harm.

"On the basis of the evidence found in this investigation, mechanical ventilation cannot be regarded as essential for schoolrooms unless they are located in noisy, dusty, or odorous surroundings, or in case of other special conditions.

"Schoolroom ventilation by means of windows and gravity exhaust flues has been found to be entirely satisfactory by those who report its use in school buildings located in various geographical sections of the United States.

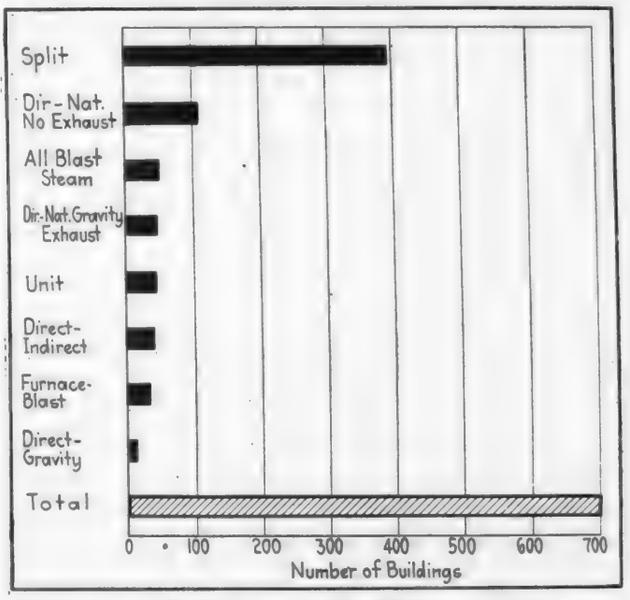
"The evidence on designs and operation of systems of mechanical ventilation, secured in this investigation, is unfavorable to mechanical ventilation." (One of the principal points made in this connection is that, as a rule, systems of mechanical ventilation are not operated outside of the heating season, so that the usual ventilating system is in reality a heating system, so far as policy of operation is concerned).

"On the basis of experimental data, the claims of mechanical ventilation for schools and hospitals were seriously challenged by 1913. With the discrediting of some of the theories in large measure responsible for the establishment of mechanical ventilation as the standard method of ventilating the schoolroom and with the growth of



Methods of Ventilation in New School Buildings in the 96 Cities Reporting

In the designations the first term of each compound word refers to the method of supplying air to the classroom and the second to the method of removing it from the rooms.



Systems of Heating and Ventilation in 700 New School Buildings in the 96 Cities Reporting

In the foregoing designations as given, "dir-nat" refers to systems having direct radiation in the classrooms for heating only. There may be either no exhaust system or gravity exhaust system, with or without accelerating heaters in exhaust flues.

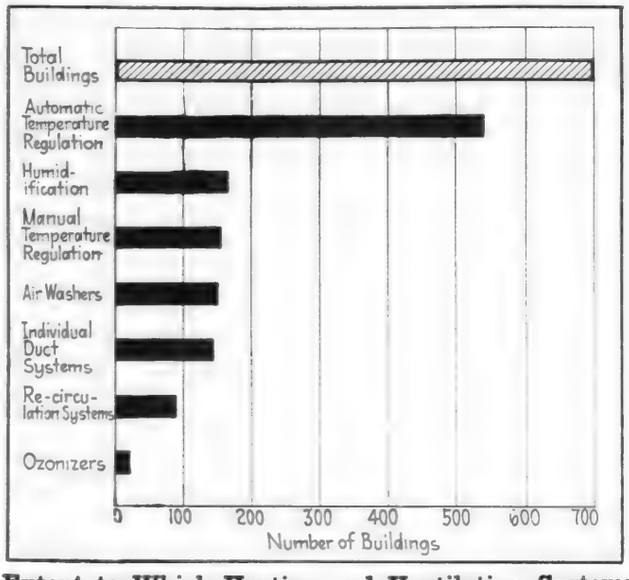
knowledge of the physiological aspects of ventilation as a background, the mounting cost of fuel, operation and maintenance during recent years served to increase the number of idle plenum fans and brought about a most serious practical challenge to the position of mechanical ventilation. The typical methods of installation and operation are now discredited.

"As a result of this situation at least two movements are being strongly supported by many of those interested in mechanical ventilation. The manufacturing and engineering aspects of these movements represent, in general, opposing views. (a) In the first place there is a movement to install ventilating units in the various rooms of a building. (b) In the second place, there is a movement to retain the traditional plenum fan system of ventilation and reduce cost of fuel by recirculating the air for ventilation. Recirculation usually calls for the washing of the air and there is also the movement, apparently limited as yet, to introduce ozone into the recirculated air stream.

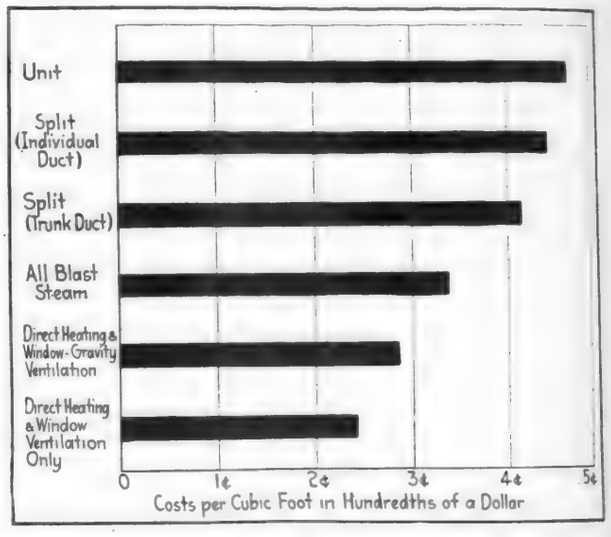
"So far as certain manufacturing and engineering forces are concerned, there seems to be a very definite effort to inaugurate a régime of air recirculation for ventilation.

"The continued existence of mechanical ventilation as a general procedure for schools depends in large measure upon the degree to which school officials and the public generally accept the principle of air recirculation for ventilation.

"The results of this investigation support the view that non-mechanical ventilation of the window-gravity type is the most desirable and practical method of schoolroom ventilation."



Extent to Which Heating and Ventilating Systems of 700 New School Buildings Were Equipped With Certain Features and Devices



Relative Costs of Various Systems of Heating and Ventilation per Cubic Foot of Building Contents

CHANGING CONCEPTIONS OF VENTILATION

In spite of the conclusions reached by Dr. McLure, especially in regard to the usefulness of the window-gravity method of ventilating a schoolroom which few will agree is to be the final solution of the ventilating problem, no one can read Dr. McLure's work without realizing how completely he has delved into the existing literature on the subject and how keenly he has fastened upon the salient points. In his opening chapter, for instance, on "Changing Conceptions of Ventilation," he presents one of the most complete summaries to be found of the theories of ventilation as they have developed. These were for long the accepted views of the profession and included the well-known CO_2 theory and the time-honored "30 cu. ft. per pupil" rule. He then shows in convincing fashion how the inexorable facts as brought out by research led to the abandonment of one theory after another until the science reached its present position of recognizing that no one method of ventilation may be set down as the most satisfactory for all school room conditions and that the physical properties of air-temperature, relative humidity and air movement are the factors of primary importance in ventilation.

BASIS OF MOST OF THE VENTILATION LAWS

From this point Dr. McLure proceeds in merciless order to link up these earlier and now discarded views on air requirements with the requirements of most of the ventilation laws now on the statute books, showing how, for that reason, such laws fail to meet the needs of the present situation as developed by more recent research.

PRESENT STANDARDS AND PRACTICE

Three chapters, constituting the major portion of the book, are devoted to an analysis and discussion of the data brought out in the replies to the questionnaire already mentioned. Under "Present Standards and Practice in School Building Ventilation," the replies, states the author, show, among other things, that:

"The installation of systems of mechanical ventilation is the established practice in the cities of the eastern, central and western States reported in this study.

"Practically without exception, systems of mechanical ventilation in these cities were designed to supply 30 cu. ft. of air per minute per person whether they were in States with or without ventilation laws.

"In cities reporting from eastern, central and western States having ventilation laws, no new school building has been designed for window air supply.

"The modified window ventilation, recommended as the most generally promising by the New York State Commission on Ventilation, has not been reported from any State having ventilation laws, except southern States.

"In cities of the eastern, central, southern and western States having no ventilation laws, the modified window, or window-gravity method of ventilation, is being used. This is particularly true of a few cities in certain eastern, central and southern states.

"The typical heating and ventilation installation is the so-called split system.

"It is recognized by leading engineers that the trunk duct system of air supply fails to provide adequately for volume of air and temperature control.

"Air washers, humidification, ozonators, and recirculation systems are infrequently provided."

PRESENT STATUS OF MECHANICAL VENTILATION

When it comes to "The Present Status of Mechanical Ventilation," Dr. McLure summarizes the information obtained by stating, among other things, that:

"An analysis of the costs of various

items involved in the contracts for four well-designed and recently-installed split systems of heating and ventilation showed that the cost of the ventilation equipment, alone, was from 43.3% to 53.5% of the total cost of the contract.

"The evidence shows that there is an investment of millions of dollars in idle split plenum fan ventilation equipment in certain cities of the United States.

"The inefficient operation of systems of mechanical ventilation, as installed, is explained by engineers, generally, on the ground that teachers persist in opening the windows. With respect to the claims of window-gravity ventilation, engineers point out, among other things, that teachers cannot be relied upon to open the windows properly. The engineers are inconsistent.

"By 1913, due to the results of research, the position of mechanical ventilation was very seriously challenged. Due to continued research, its present status is more insecure than at any time since it was proposed as the most satisfactory method of classroom ventilation."

COSTS OF INSTALLATION

Finally, under "The Cost of Installation of Heating and Ventilating Systems," Dr. McLure shows that schoolroom ventilation by windows and gravity exhaust flues costs 39% less than unit ventilation; 35% less than split plenum fan ventilation with individual ducts, and 30% less than split plenum fan ventilation with trunk ducts.

OZONE

Dr. McLure has little to say on the use of ozone in ventilation. He quotes from the report of the New York State Commission on Ventilation whose experiments with ozone were so incomplete and with an ozonator of such an early type, as hardly to constitute a guide in this connection. He also refers to the experiments carried on at the A.S.H.&V.E. Research Laboratory in Pittsburgh, but these, as we know, are still incomplete. The most important point brought out by the author in connection with ozone is the evidence that ozone in quantities sufficient to destroy bacteria might easily be harmful to health.

THE SYNTHETIC AIR CHART

Much more importance will be attached to Dr. McLure's reference to the Synthetic Air Chart of the American Society of Heating and Ventilating Engineers and to its use in connection with the proposed standard code for heating and ventilating being compiled by the society.

"The factors of the Synthetic Air Chart," states Dr. McLure, "may be divided into three classes, as follows: (1) wet-bulb difference, involving temperature, humidity and air motion; (2) dust, bacteria and odors; (3) carbon dioxide, as an index of air supply and distribution." He then expresses his doubts as to whether the wet-bulb temperature is the best measure of air conditions in schoolrooms, but inasmuch as the wet-bulb basis in the Synthetic Air Chart has been modified to the "effective temperature" basis since Dr. McLure's thesis was written, this criticism loses its point.

The author, however, takes the position that the factors of odors and carbon dioxide have no place in the Synthetic Air Chart, declaring that according to his evidence dust, bacteria, odors and carbon dioxide as factors may be useful as tools of investigation but have no place in connection with standards for classroom ventilation.

How Snow is Melted on the Roof of a Boston Commercial Building by Steam Pipes

Hints on Gas Burner Selection

Probably the first item to be taken up in considering the installation of a gas burner is the adaptability of the burner to the conditions of fuel characteristics in the locality.

It has been the practice of many manufacturers to test their burners only on the gas available at the factory, possibly supplemented by the tests of a dozen or so placed in the hands of their agents. As the agents are seldom technical men, the results obtained cannot be expected to more than indicate the universality of the burner. A much better plan, it would seem, would be to submit the burner to a laboratory of recognized repute, where comprehensive and authoritative tests would be made and correct conclusions drawn.

Many gas burner installations have come to grief because they either lacked the correct design or the proper adjustment to operate on the kind of fuel available. In many cases a burner might be so adjusted as to give satisfactory results on high pressure, and yet, when installed and served with low-pressure gas, entirely fail as an economical heat producer.

To the "cost of sales" of a burner must, by the reputable manufacturer, be added the "cost of service," and, to the buyer as well as the seller, this item is of no small importance. A shut down of a burner for an hour may mean a service cost of only fifteen or twenty dollars to the agent who installed the burner, but it may mean a loss of hundreds of dollars to the user, who may have to hold up production for a period, without a corresponding stoppage of the pay roll.

Consequently both the purchaser and the seller of a gas burner should carefully determine the actual fitness of the burner in question to the conditions of gas supply actually obtaining in the future with due regard to the possibility of changed conditions.

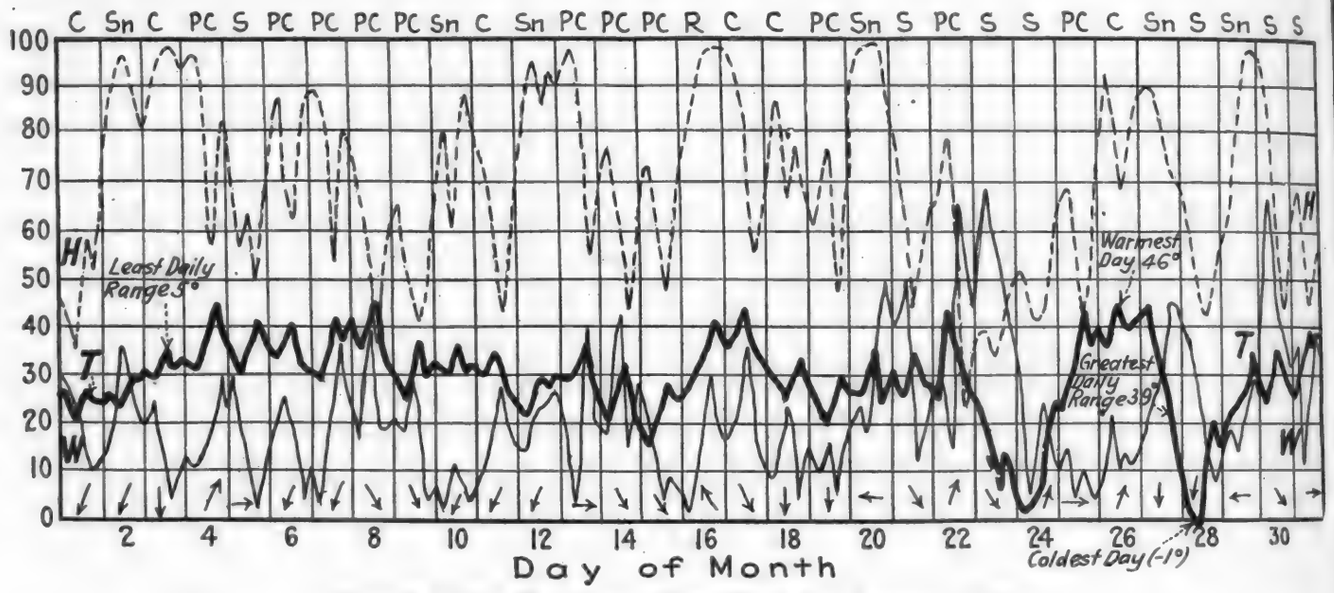
Steaming Snow From Roofs

A novel method of snow removal from roofs of commercial buildings has been developed in Boston, where the experiment has eliminated the danger to pedestrians in the street below from falling clods of ice and snow.

It is, in reality, a preventative method, in that steam is turned into properly installed and drilled pipes as soon as snow starts to fall. As a result the snow is melted as fast as it strikes the roof and runs off as water.

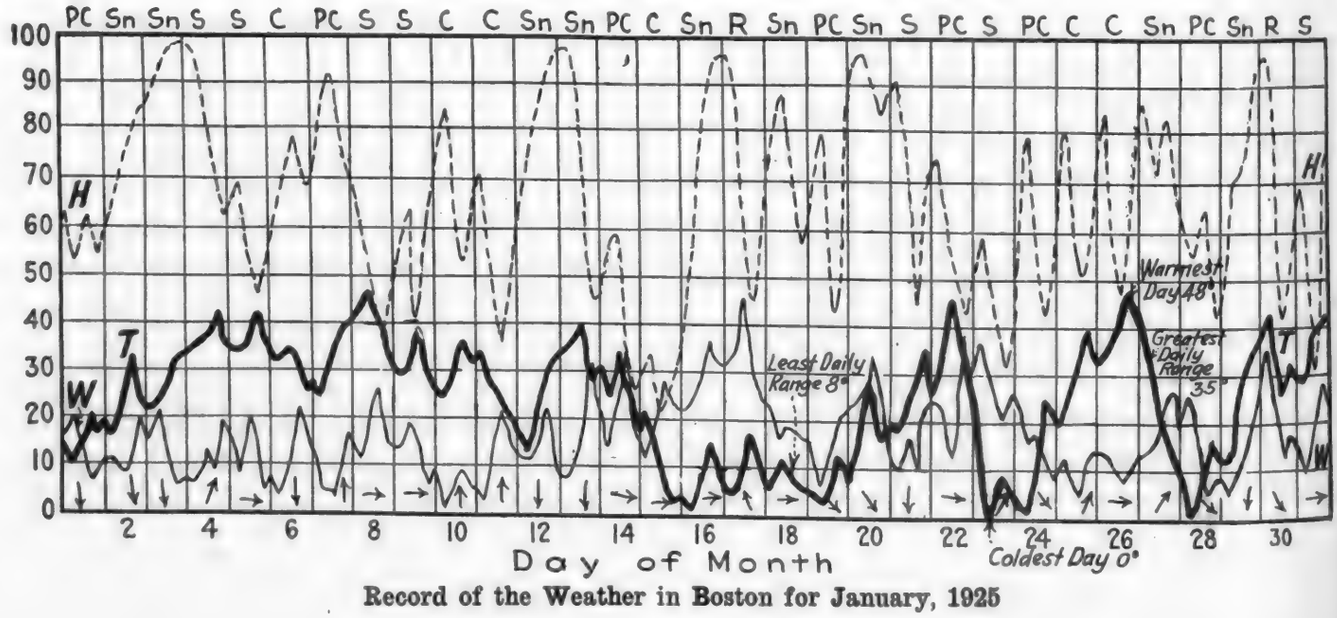
The Weather For January 1925

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature	46	48	53	44	57
Date of highest temperature	26	26	7	31	25
Lowest temperature, deg. F	–1	0	–3	5	8
Date of lowest temperature	28	23	28	28	27
Greatest daily range, deg, F	39	35	33	33	39
Date of greatest daily range	27	27	24	26	26
Least daily range, deg. F	5	8	4	4	4
Date of least daily range	3	18	3	1	1
Mean temp. for month, deg. F	29.1	27.2	29.8	25.9	33
Normal mean temp. for month. deg. F	30.9	27.8	30.5	25.1	31.2
Total precipitation, in	5.3	3.97	3.56	0.68	0.53
Total snowfall, in	2.51	2.07	2.62	6.8	4.9
Normal precipitation, this month, in	3.79	3.82	2.87	2.00	2.27
Total wind movement for month, miles	14030	8850	8984	7918	8383
Average wind velocity, miles per hour	18.9	11.9	12.1	10.6	11.3
Prevailing direction of wind	N. W.	W.	W.	W.	S.
Number of clear days	7	8	2	9	12
Number of partly cloudy days	11	11	11	9	8
Number of cloudy days	13	12	18	13	11
Number of days with precipitation	11	11	14	5	5
Number of days with snow	9	10	10	4	4
Snow on ground at end of month, in	7.4	5.0	10	Trace	None

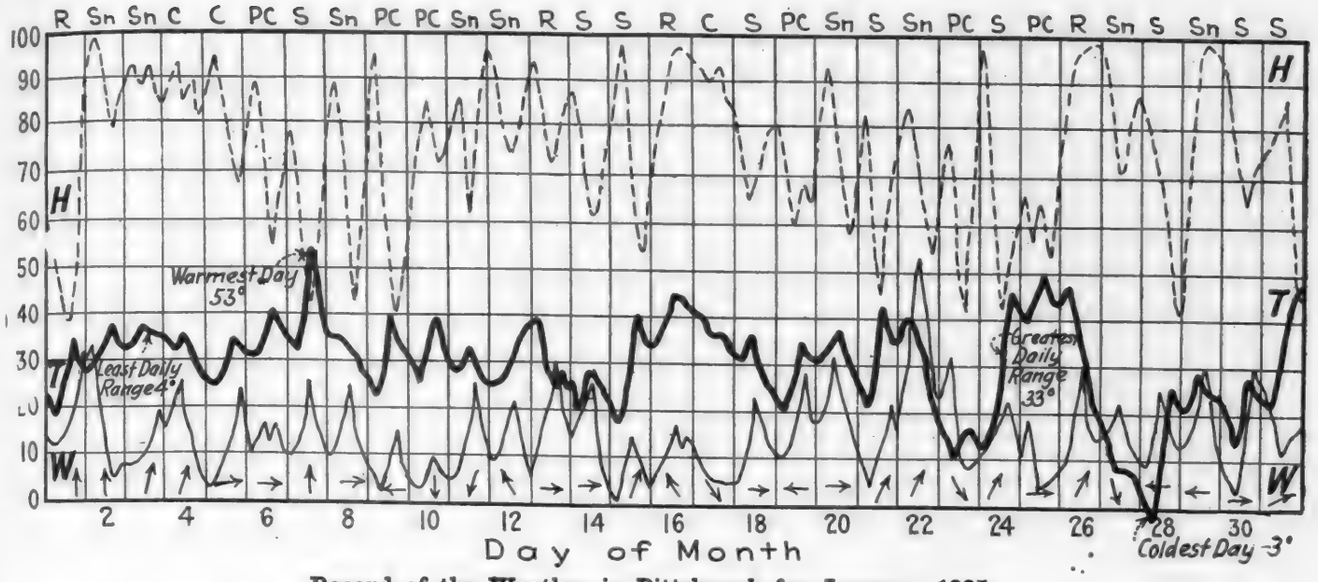


Record of the Weather in New York for January, 1925

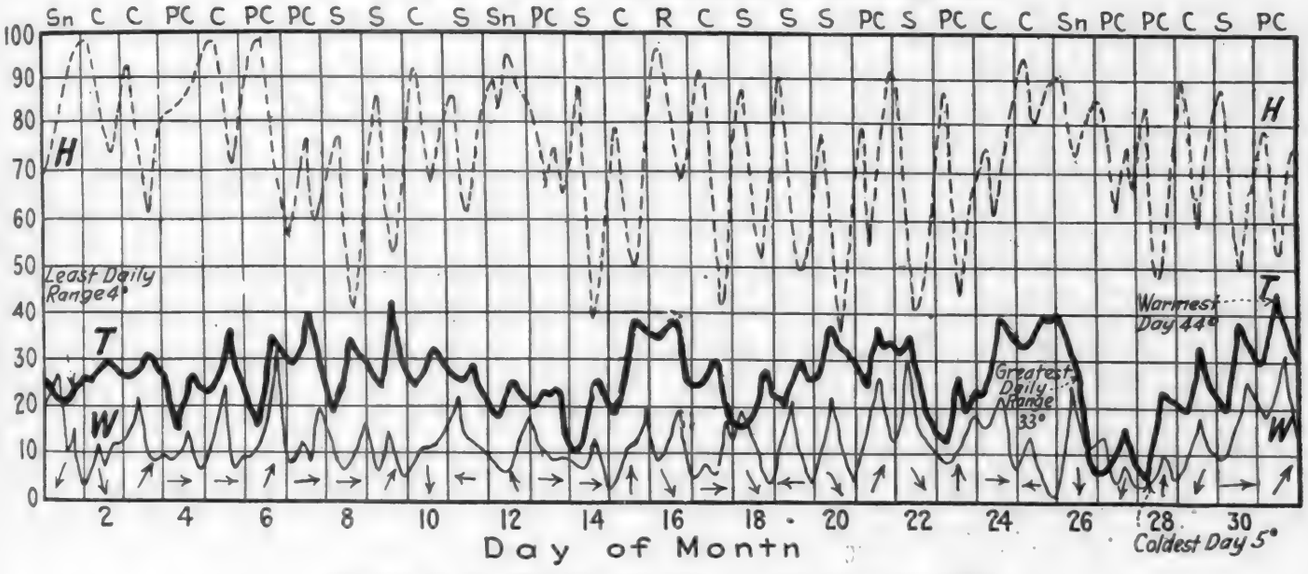
(Hourly Observations of the Relative Humidity Plotted on This Chart)



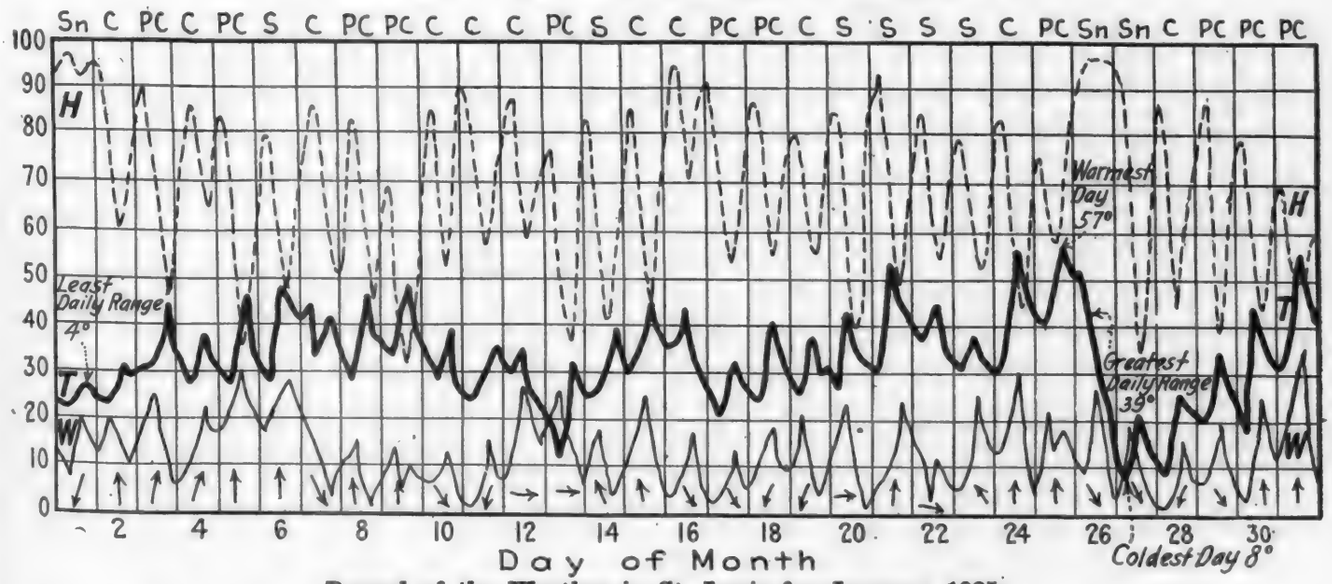
Record of the Weather in Boston for January, 1925



Record of the Weather in Pittsburgh for January, 1925



Record of the Weather in Chicago for January, 1925



Record of the Weather in St. Louis for January, 1925

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F. Light Lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M. Arrows fly with prevailing directions of wind.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow.

New Data For Figuring Chimney Heights and Flue Sizes

THE proper cross-sectional area for a flue depends upon the rating or size of the heating appliance, whether it be warm-air heater, steam or water boiler, stove, range or domestic water heater. Flue and smoke-pipe sizes, in the past, have been based on the many various sizes of flue linings commonly manufactured and in few of these cases were the actual inside effective areas of the flue linings taken into consideration.

In some tables, the sizes were admittedly purely theoretical and bore little relation to the actual sizes of flue linings commercially available.

In compiling the data for this publication on flues and flue linings, an investigation was made of the sizes of flues recommended by many manufacturers of heaters and the above facts became apparent.

It was also found that the table of "Minimum Chimney Flue Sizes and Heights" contained in the "Ordinance for the Construction of Chimneys" of the National Board of Fire Underwriters, did not list the sizes of flue linings which would conform to the standards now adopted and which are commercially available in all parts of this country. Furthermore, this table was figured on outside sizes and the actual cross-sectional inside area was not stated, nor was the thickness of the shell of the lining taken into consideration.

EXAMPLE AS WORKED OUT BY UNDERWRITERS' ORDINANCE

A typical example of the confusion which might arise from the use of this table is given here.

An architect has 700 sq. ft. of water radiation for which to provide a flue. Referring to the table, he selects an 8-in. x 12-in. flue, not realizing that these figures are outside dimensions and that the actual inside effective area of a flue lining would be considerably less.

If the chimney is built unlined, these dimensions are the inside measurements of the masonry according to the note at the head of the table. If he wished to use flue lining, however, he calls for an 8–in. x 12–in. flue. This size was formerly manufactured but is no longer available and instead of getting a flue 96 sq. in. in area, he would get one 8½–in. x 13–in. from which must be deducted a thickness of ¾–in. for the shell on all sides, making the inside measurements 7–in. x 11½–in. or an area of 80.5 sq. in. which may be totally insufficient for the type of heater installed.

Realizing these discrepancies, the Structural Service Bureau, Philadelphia, acting for the Eastern Clay Products Association, manufacturers of fire-clay flue linings, undertook to revise the table of flue sizes in the Chimney Ordinance of the N. B. F. U., changing the ratings for apparatus to accommodate them to the inside dimensions of the new standard sizes of flue linings. It was decided to present at the same time columns of data giving the "actual" and "effective" inside flue areas in the light of the most recent investigations and research so as to eliminate as far as possible the necessity for any additional figuring by

* From a manual on "Flues and Flue Linings with Related Data on Chimneys and Fireplaces," issued by the Eastern Clay Products Association.

TABLE OF STANDARD SIZES OF RECTANGULAR FLUE LININGS AND ROUND FLUE LININGS

Warm Air Furnace Capacity Sq. In. of Leader Pipe	Steam Boiler Capacity Sq. Ft. of Radiation	Hot Water Heater Capacity Sq. Ft. of Radiation	Rectangular Flue				Round Flue		Height in Ft. from Grate
			Nominal Dimensions of Fire Clay Lining Inches	Actual Inside Dimensions of Fire Clay Lining Inches	Actual Area Square Inches	Effective Area Square Inches	Inside Diameter of Lining Inches	Actual and Effective Area Square Inches	
790	590	973	8½x13	7 x11½	81	70	..	...	35
1,000	690	1,140	.....	.....	...	...	10	79	..
...	900	1,490	13 x13	11¼x11¼	127	99	..	...	..
...	900	1,490	8½x18	6¾x16¼	110	100	..	...	..
...	1,100	1,820	.....	.....	...	...	12	113	40
...	1,700	2,800	13 x18	11¼x16¼	183	156	..	...	..
...	1,940	3,200	.....	.....	...	...	15	177	..
...	2,130	3,520	18 x18	15¾x15¾	248	195	..	...	..
...	2,480	4,090	20 x20	17¼x17¼	298	234	..	...	45
...	3,150	5,200	.....	.....	...	...	18	254	50
...	4,300	7,100	.....	.....	...	...	20	314	..
...	5,000	8,250	24 x24	21 x21	441	346	..	...	55
...	4,600	7,590	.....	20 x24	480	326	..	...	..
...	5,570	9,190	.....	24 x24*	576	452	..	...	60
...	5,580	9,200	.....	.....	...	...	22	380	..
...	6,980	11,500	.....	.....	...	...	24	452	65
...	7,270	12,000	.....	24 x28	672	468	..	...	..
...	8,700	14,400	.....	28 x28	784	531	..	...	..
...	9,380	15,500	.....	.....	...	...	27	573	..
...	10,150	16,750	.....	30 x30	900	616	..	...	..
...	10,470	17,250	.....	28 x32	896	635	..	...	..
...	11,800	19,500	.....	.....	...	...	30	707	70
...	14,700	24,300	.....	.....	...	...	33	855	..
...	17,900	29,500	.....	.....	...	...	36	1,018	..

*Dimensions below are larger than those in which rectangular fire clay flue linings are commercially available and hence are for unlined rectangular flues—requiring thicker walls than when lined. Note that the effective area of an unlined flue is based on the formula in Paragraph (g) above.

the designer. This has been accomplished and the accompanying table presents these recommendations.

FLUE LININGS 8½–in. x 13–in. AND OVER

Using this table any one can select a flue size and chimney height for any given rating in terms of effective cross-sectional area, based on inside dimensions of a lined flue and be assured it will be adequate for the heater having that given rating.

In the example previously given the heater rating was 700 sq. ft. Referring to the table it will be found that a rectangular flue 7–in. x 11½–in. inside having an actual net area of 80.5 and an effective area of 70 sq. in. is required. The chimney should be at least 35 ft. high for hot water and 40 ft. for direct steam.

It should be noted that in this table the minimum height of the chimney above the grate is given as 35 ft. but some authorities claim that any chimney under 40 ft. in height will produce an erratic draft depending upon the force or direction of the wind, the amount of moisture in the air or the size and quality of the fuel. The higher the chimney, the less are the effects of these factors.

When gas is the fuel used in a heating furnace, boiler or automatic water heater, the flue should be the same size and construction as required for stoves and ranges using other fuel. Vent flues where required for other domestic gas burning appliances may be of smaller size but should be not less than 10 sq. in.

The accompanying table gives the minimum flue sizes allowable for the corresponding sizes of warm-air furnaces, boilers or water heaters. In connection with this table the following points should be noted:

(a) The ratings given are based on smooth, lined, straight flues. If there is more than one offset or if any single offset is flatter than 60° with the horizontal, the rating should be reduced accordingly.

(b) The dimensions given for the flue linings are the nominal dimensions and the actual inside clear dimensions. For rectangular flues the nominal or commercial dimensions are the outside dimensions; for round flues the nominal diameter is the inside diameter. In computing the area of square and rectangular flues, the corners have been eliminated and the resultant effective area computed from the formula.

$$e = \pi \times \left(\frac{B}{2}\right)^2 + B\ (A—B)$$

In this formula (e) equals the effective area and (A) and (B) equal the inside length and width respectively. The effective area is also shown in the table.

(c) The flue linings listed are standard sizes adopted by the Eastern Clay Products Association.

(d) Flue sizes are based on run-of-mine soft coal but are to be used without reduction for any fuel. The smaller sizes of fuels require excessive draft and when the fuel to be used is screened smaller than the following, each installation requires especial consideration: Anthracite—nut, Bituminous—run-of-mine, Coke—nut.

(e) Steam and water boiler capacities are the rated capacities of the manufacturer.

(f) Flue heights and sizes are based upon an altitude not over 500 ft. above sea level. For each 1,000 ft. above sea level the height of the flue for a given appliance should be increased 10% above the figures in the table and the capacities in the table should be reduced 5%.

(g) The effective area of an unlined round flue shall be based upon a diameter 2 in. less than the actual diameter. The effective area of an unlined rectangular flue shall be computed from the formula:

$$\text{Effective area in square inch} = \frac{\pi\ (B–2)^2}{4} + (A–B)\ (B–2)$$

in which (A) and (B) are respectively the long and short inside dimensions in inches.

(h) When a flue for any reason must be built more than 100% in excess of the areas given in the table, it shall be capped with stone terra cotta, cast-iron or other approved material, having an opening not more than 50% greater than the required area.

(i) When two appliances are to be connected to one flue, the rated capacities of flue of various sizes shall be taken as 60% of those given in the table. When three appliances are to be connected, the capacities shall be taken as 40% of those given in the table. When four appliances are to be connected, the capacities shall be taken as 35% of those given in the table.

(j) The flue heights and sizes are for ordinary up-draft boilers. For special types of boilers greater heights and area may be required.

Correspondence

Free Engineering

EDITOR HEATING AND VENTILATING MAGAZINE:

An incident, illustrating the view taken by heating contractors on engineering charges, happened to the writer who was talking to a Mr. A., who had a plant to be heated.

During the conversation, which was in a public place, a contractor sauntered over, and addressing himself to Mr. A., stated that he would make drawings and specifications for heating his building and the service need not cost him a cent.

Turning to the writer, the contractor said that his cousin, a very good heating engineer, was looking for a permanent job and he thought that the writer should add him to his organization.

The contractor was very indignant when his attention was called to the chance that an engineer had of earning his salary if contractors solicited this class of work and made no charge for it.

Cincinnati, O. E. M. C.

An English Method of Extending the Vacuum to the Inside of the Radiator

EDITOR HEATING AND VENTILATING MAGAZINE:

In the October number of HEATING AND VENTILATING MAGAZINE I read a very good article as to the "creation of a vacuum in the interiors of radiators and other heating surfaces" and I thought I might give the gentleman interested in this article some useful information, if he so desires, upon what we have been doing here in this respect for the last 20 years.

I enclose herewith a small brochure entitled "Artificial Heating Automatically Controlled," which will indicate to you what we have been doing with the "Nuvacumette" system in this country where we carry anything from 10 in. to 15 in. of vacuum on the internal surface of the radiator and get extremely good results.

It will be within your recollection that I visited the States with this system some 15 or 16 years ago when I had the pleasure of seeing you at your

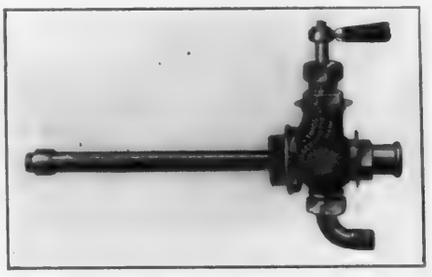


Fig. 1. Radiator Supply Valve with Thermostatic Member

office and I had fixed up at Messrs. Kieley & Mueller's Works a sample plant in which I had hoped to have got some of you good people in America interested in, but after spending a lot of time with an old friend of mine out west the whole proposition fell to the ground and nothing further came of it. We have, however, made some very large installations indeed in this country with this system and, although

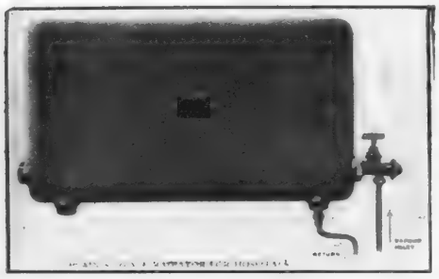


Fig. 2. Special Control Valve Applied to Plain-Surface Hospital Radiator

the patents have run out, we still keep doing it.

As installed, the exit end of the radiator is entirely open and free to the return pipe and has no valve on it whatever. Furthermore we do not use any water for condensing purposes.

We are maintaining on jobs that have been put in some 10 to 12 or 15 years, 10 in. to 15 in. of vacuum continuously and some of the plants run continuously all the year round where they are used for business purposes.

Leicester, England. D. M. NESBIT.

In the system described by our correspondent, in addition to the novel and (to us in this country) rather original features of design embodied, there are many points of interest as they cover certain of the questions raised in these columns during the last few months regarding the feasibility of extending the vacuum to the inside of a radiator.

According to the description of this system, as given, the amount of steam or vapor admitted to the radiator is automatically controlled by a valve designed with a thermostatic member as shown in Fig. 1. The application of this valve to a radiator is shown in Figs. 2-3. When it is desired to control the temperature of a room by means of a room thermostat located directly in the room this valve (or as many more as there are radiators in the room) is connected with the thermostat in one of several ways, the choice depending upon conditions. Thus, vacuum or compressed-air lines

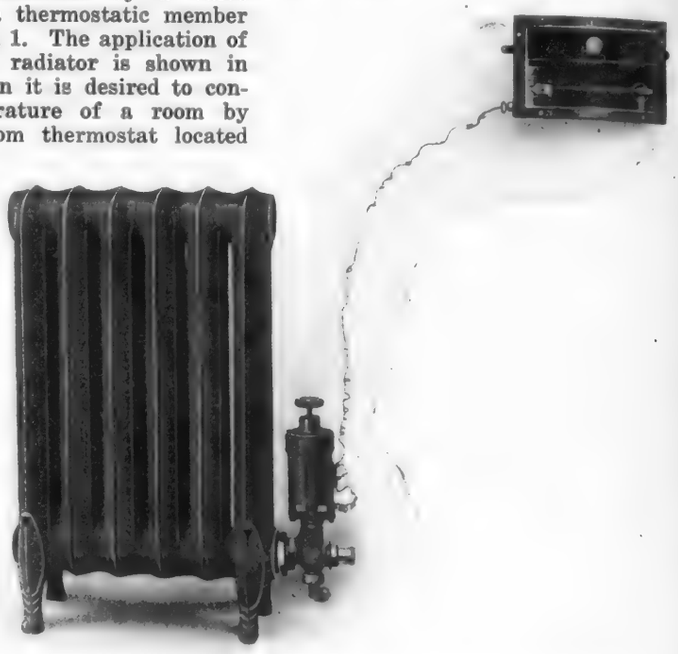


Fig. 4. Electrical Thermostat for Controlling Thermostatic Radiator Supply Valve

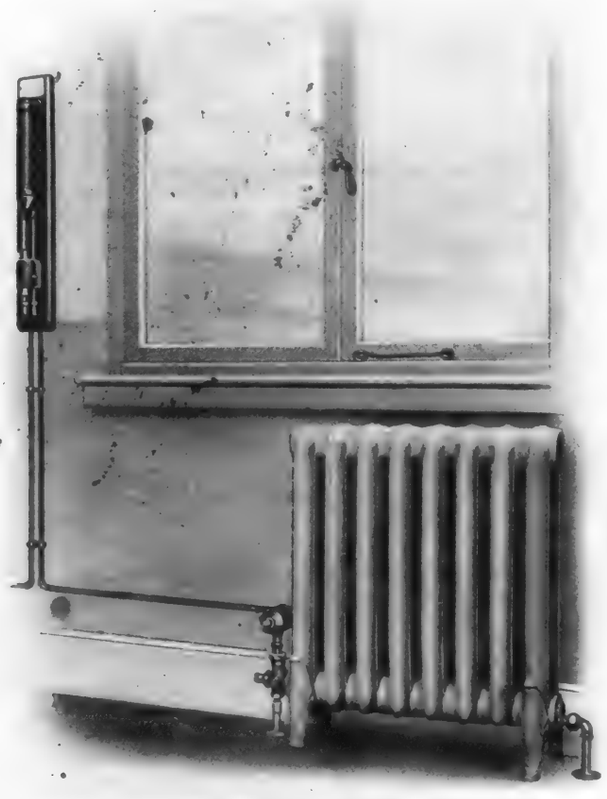


Fig 3. Temperature Control Thermostat with Connection for Operating Thermostatic Radiator Supply Valve

or a fluid may be used, as shown in Fig. 4, electricity as shown in Fig. 5, or else the control of temperature may be effected by means of an automatic valve (Fig. 6) connected directly to the steam supply main located in the room. In the latter case the thermostat forms a part of the automatic valve and operates so as to maintain the constant temperature for which the device is set.

On larger installations a vacuum pump is provided and connected to the return end of the radiators in order to maintain a vacuum which may be varied according to the outside temperature, also in order to give a more positive circulation, as is particularly desirable when starting up. As there is no valve on the outlet of the radiator it will be apparent that the vacuum extends to the inside of the radiator making it possible to vary the temperature within the radiator from 200° to 180° F., or even less.

Other points regarding this system, some of which are common to all vacuum systems, are that no matter how far the radiator may be from the source of supply, the temperature of each radiating surface may be automatically, individually, and economically controlled with only one valve on each radiator and without overheating, water hammer, risk of freezing, or discharge of air into the room.

In the system described it is pointed out that no leakages can take place as the pressures within the system are lower than that of the atmosphere,

nor is there any loss of heat such as may take place in a forced water heating system where heat is transferred from the steam to the water. It is further pointed out that in the case of water heating systems in high buildings, for example, say a building 100 ft. high, the pressure in the water heater due to the head of water would be as great as 43 pounds.

Selecting one from the many charts in the catalogue of temperature records taken from installations of the system describing it the curves show that during the 24 hours recorded by the

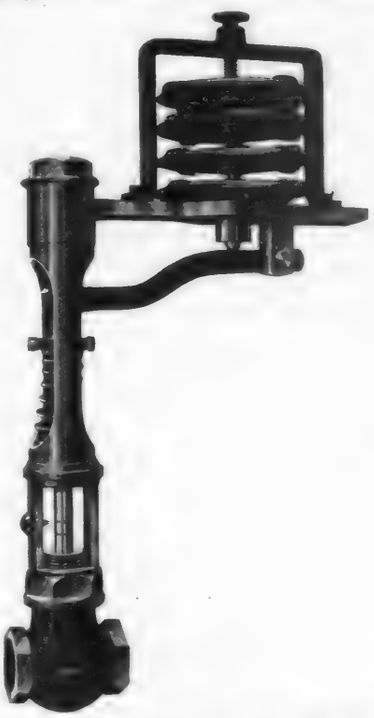


Fig. 5. Temperature Control Valve Located in Steam Supply Main in the Room

chart the system was working 9¾ hours only, during which time the valve controlling the steam supply was open 2¼ hours or 23.2% of the total time working and closed 7½ hours or 76.8% of the total working day of 9¾ hours. Throughout the day the mean external temperature was 39° F. and the temperature of the room variable from 61° to 62° F., at which temperature the system was set. The coal saving for this day of 24 hours was 76.8%.

Notes on Fan Standardization

EDITOR HEATING AND VENTILATING MAGAZINE:

Oswald Stott, in the course of a lecture in London recently, showed the necessity for fan standardization. Mr. Stott referred to the committee recently formed in Great Britain to deal with the subject, and expressed the view that there was no reason why the difficulties should not be pointed out and explained, because they might be partially avoided, pending a common method being put forward by the committee, by stating clearly what was desired when sending out an inquiry for a fan.

For example, a fan is required for an induced draft in a battery of boilers, where the main flue to which the fan connects is usually much larger than the fan inlet, so that the velocity is much less. The draft specified is invariably that required in the main flue (where the velocity is much lower than through the fan inlet), so that it will not do to specify, say, 1½ in. W.G. "static" without saying that this draft is required in the main flue. Otherwise a fan would be put forward by some fan-makers giving 1½ in. W.G. "static" at the fan inlet, and the 1½ in. W.G. would then include the "velocity W.G." at the fan inlet, giving a much less draft in the main flue.

In a ventilating plant which has a duct upon the inlet side it is advisable to state clearly whether the water gauge specified includes that required to produce the velocity, or whether it is the resistance only. If the water gauge on the inlet side is specified as, say, 2 in. W.G. "static" (at the fan inlet), it means that the velocity W.G. has been included, so that, if the 2 in. W.G. is the resistance, it is, pending the suggestions from the committee, considered advisable to specify, "against a resistance of 2 in. W.G., excluding velocity."

Mercury Vapor versus Steam

In an address made at the recent celebration of the centenary of the founding of the Franklin Institute, Dr. W. L. R. Emmet, of the General Electric Company, outlines the principles of the "Emmet Mercury Vapor Process," and, from data obtained in the experimental station at Hartford, Conn., described in THE HEATING AND VENTILATING MAGAZINE for February, 1924, predicts economies to be expected in the 50,000 k.w. high-pressure unit to be installed at Chicago.

The Emmet process makes possible improved thermo-dynamic efficiency from fuel used for power production through the use of a greater temperature range than is practicable with steam.

Dr. Emmet says: "Water boils at 212° F., has a pressure of 3,200 lbs. per square inch at 706° F., and cannot exist as a saturated vapor at any higher temperatures. As it approaches this critical temperature its latent heat of vaporization progressively diminishes and the heat in the liquid increases. These peculiarities and temperature limitations introduce certain practical difficulties in the effective use of steam to high temperatures, in addition to those which are incident to the excessive pressures which must be handled.

"Mercury boils at 677° F. with atmospheric pressure, and at 706° has a pressure of only 5 lbs. above the atmosphere. At 900° F. its pressure is only 80 lbs. above the atmosphere. Throughout this entire range, its heat of evaporization only varies slightly and the heat in the liquid is relatively very small, which qualities excellently adapt it to thermo-dynamic purposes. in a boiler from which it is conveyed

"In this process, mercury is vaporized in a boiler from which it is conveyed in a pipe to a turbine which drives a generator. On exhausting from this turbine at a vacuum pressure, it delivers its heat of vaporization to tubes in which high pressure steam is thereby generated. This steam can be applied to any purpose. After condensing on this steam-making surface the liquid mercury runs back by gravity into the boiler where it is again vaporized. With a view to cost reduction, the boiler is designed to operate on a very small volume of mercury and the total quantity may be vaporized nine or ten times in an hour. The furnace gases, after passing through the mercury boiler, are carried through a heater to raise the temperature of the returning liquid mercury, then they pass through a superheater for the steam made, and then through an economizer for heating feed water, so that they arrive at the stack as cool as in a simple steam process with similar arrangements.

"If this process can be developed to a thoroughly workable condition, the economies obtainable are very high. With steam conditions equivalent to those in the best existing power stations, the gain in output per pound of fuel should be from 50% to 80%, and, as compared with the possibility of the very high-pressure installations contemplated, the gains should still be very large."

Oil and Gas Power Week

Under the patronage of fourteen leading national engineering societies, and of the Bureau of Mines, and Geological Survey, of Bureau of Standards of the United States Government, there will be held throughout the country, during the week of April 20-25, meetings devoted to discussion of the leading problems of conservation of oil and gas for power purposes.

Conditions of only twenty years ago have been completely changed, and we find more power developed from oil and gas to-day than were then utilized from steam and water combined. Automobile engine ratings alone aggregate over forty million horse power. As a consequence, if a saving of only 1% could be effected, it would mean several million cubic feet of gas, or gallons of oil.

The committee in charge of this comprehensive undertaking is headed by W. F. Durand, president, A. S. M. E., and includes James F. Norris, president A. C. S.; J. Edgar Pew, president A. P. I.; C. E. Lueke, W. Trinks, L. H. Morrison and W. E. Bullock, secretary, Engineers Club, New York.

Programs are being prepared, which will be participated in by leading oil companies, manufacturers of oil and gas equipment, users, operators, and engineering schools, and all are coöperating to bring out all the problems of conservation in this basic field, focusing the attention of experts on economy, and increasing the benefits already derived from oil and gas.

American Society of Heating and Ventilating Engineers

Western New York Chapter Discusses Oil Heating From The Contractors' Viewpoint

UNDER the title "Oil Heating from the Contractor's Standpoint," A. DeRosa, a member of the firm of A. DeRosa & Co., Utica, N. Y., gave a talk on the history and principles of oil and oil burners at the January meeting of the Western New York Chapter, in Buffalo, January 12.

Mr. DeRosa emphasized the point that the heating engineer and contractor who are interested in oil burners should devote some time to the study of oil for heating, as the knowledge of the various kinds of oil necessary is the first step. It is important to consider fuel-oil of low gravity because of its greater heat value and lower price. There always will be an adequate supply of fuel-oil. Kerosene and light distillates cannot long be used as fuel oil.

The refiners are rapidly coming to a standardization of fuel-oils for house heating, specifications are being narrowed, and it is now possible to buy even the heavier grades of fuel-oil within as narrow limits of gravity and cold test as kerosene or the lighter distillates. The price of the heavier fuel-oil is more staple. Stability of price and uniformity of product are of the utmost importance in building a permanent house heating fuel-oil and oil-burner business.

There are four principles which must be obeyed in order to burn fuel-oil successfully: First, the oil must be atomized or nebulized (nebulized is finer than atomization); second, the oil must be burned in suspension before it comes in contact with any heating surface; third, the oil must be burned in the presence of a refractory material; and, fourth, a minimum quantity of air must be supplied for combustion and intimately mixed mechanically with the atomized or nebulized oil.

All oil burners may be classified under three general types or combination of them: First, spray atomizers; second, mechanical atomizers; and, third, generative-spray atomizers, with either steam or compressed air to break the oil into fine particles or mist.

Mechanical atomizers merely force the oil under pressure through a small orifice. The generative type evaporates the oil by means of heating by hot plates, pots, or similar arrangements.

Mr. DeRosa expressed his belief that a burner having a combination of spray and mechanical methods, without the necessity of providing either compressed air or steam, is the best. He stated that there are 2,300 oil burners on the market of various kinds, of which about 1,400 patents have already been issued. He claimed that only oil burners that can burn the heavier grades of fuel-oil will remain. The others must go sooner or later because the lighter oils cannot be had or its price will become prohibitive.

Mr. DeRosa touched on the service parts of the burners. He said that the contractors or the engineers going into the oil-burning business must become a public utility man and he advised not going in the oil-burning business unless one was prepared to render the service that becomes necessary with the installing of oil burners, since the public expects every consideration and prompt service. Only with this in mind can one operate successfully and do much towards the advancement of the oil burners.

Mr. DeRosa brought out the fact that most of the service required is due to the fact that the public will tamper or play with the thermostatic controls. The public should be cautioned not to tamper or make any adjustments to the thermostatic control. This should be done by the service man. Monthly inspections must be made of all installations and a charge for this is made after the first year. Mr. DeRosa advises that the society lend more effort to the study and advancement of oil-heating for the benefit of the heating engineers and contractors.

Unit Heaters the Subject of New York Chapter's February Meeting

Unit heaters, both of the ventilating type and of the industrial heating type, were discussed at length at the February meeting of the New York Chapter which was held February 16 at the Building Trades Employers' Club. A record attendance of 106 was registered.

Following an announcement that the Kewanee Boiler Company had subscribed $1,000 to the society's Research Bureau each year, for a period of five years, the meeting was turned over to the chairman of the evening, F. R. Still. Mr. Still stated that due to the illness of George E. Otis, production manager of the Herman W. Nelson Corporation, Moline, Ill., and to the non-arrival of Mr. Otis's lantern slides, he would call upon Mr. Nesbitt, Jr., of John J. Nesbitt, Inc., manufacturers of the Universal unit ventilators.

Mr. Nesbitt devoted the first part of his address largely to the company's efforts in developing a noiseless alternating current motor for use with this unit. He described the tests which had been conducted to secure a noiseless motor of this type with a view of doing away with motor generating sets. It was found at first that although a noiseless A. C. motor could be constructed, a humming effect would be noticed when it was attached in the cabinet.

The effect was tried of reducing the number of bearings, and reducing the area of the motor-board support. The bearing surface of 120 in. was reduced to 27 in. through the use of a ⅛-in. angle support which took the place of 1-in. wide angle support. The company also adopted a three-point suspension for the motor so that it could be adjusted to an uneven floor space.

With these refinements, stated Mr. Nesbitt, it was possible to use polyphase A. C. motors in any type of building, and a power consumption could be figured of 10 watts per 100 cu. ft. of air. This, he said, exceeded the possibilities with a direct-current motor.

Discussing the use of Cartridge copper heaters in unit ventilators, Mr. Nesbitt stated that his experiments showed an increase in the outlet temperature with an increase of air velocity up to 1200 ft. per minute. This temperature rise compared with cast-iron as 112° to 80°. He was frank to state that Vento heaters are more efficient per square foot, but it is possible to get more surface of the Cartridge units in a given space. When the air velocities through the Cartridge cores are increased above 1200 ft. per minute, the efficiencies, he stated, exceed those of cast-iron heaters.

Speaking on the general subject of unit ventilators as compared with fan duct systems, Mr. Nesbitt mentioned the psychological effect of being able to feel warm air entering rooms from outdoors. As to comparative efficiencies, he felt that the main difference in favor of unit ventilators was due to the loss of heat in the ducts of central fan systems. Recirculating fan systems, he said, come the nearest to meeting the requirements of any fan system, but these require return ducts, making the space requirements a factor. Basement heights can be reduced with unit ventilators. He also had a word to say regarding the cleanliness of unit heaters as compared with fan duct systems.

INDUSTRIAL HEATERS

Unit heaters as applied to heating of industrial plants was presented with the aid of stereopticon views by H. Berkeley Hedges, manager of the New York office of the York Heating and Ventilating Company of Philadelphia. Mr. Hedges classified unit heaters for industrial plants as those of the direct-fired type, and those of the heating-coil type. He also differentiated the various constructions of unit heaters, such as those of the horizontal and of the

vertical type. He mentioned the high salvage value of portable units.

As for capacities he stated that it was now possible to furnish equipment running from 50,000 to 2,000,000 B.T.U. per hour, supplying 1,300 to 25,000 cu. ft. per minute, and calling for ¼ to 10 H.P. He showed a number of tables with comparative figures of the fan blast system, direct radiation system and unit heater system, bringing out in this way the economical features of unit heaters. The slides were devoted mainly to installations of the York unit heater, one of the most notable being a view of the plant of the Atwater-Kent Company, Philadelphia, where 25 York unit heaters supply the necessary heat to this unusually large floor space, while a proposed extension is being planned in which 16 additional unit heaters will be installed.

Regarding the effectiveness with which unit heaters could be used for warming various types of industrial buildings, he made the point that this was controlled largely by the condition of the buildings as regards leaks, indicating that a leaky structure would not only have a cooling effect in itself, but would interfere with the satisfactory operation of the unit heaters.

Western New York Chapter met at the Hotel Buffalo, Buffalo, N. Y., February 19, the meeting being devoted to the subject of "Anthracite Economies." Papers were presented by D. Knickerbacker Boyd, consulting architect of Philadelphia; William Auman, of the Anthracite Economies Co., and C. A. Connell, combustion engineer of the same organization. The talks were illustrated with motion pictures, and induced an interesting discussion. Local chapters of the following societies joined in the meeting: American Institute of Architects, Associated General Contractors of America, Heating and Piping Contractors National Association and the Engineering Society of Buffalo.

Swells Funds of A. S. H. & V. E. Research Laboratory

In addition to subscriptions of $7,900 to the A. S. H. &. V. E. Research Laboratory by manufacturers, announced at the society's Boston meeting, additional subscriptions have since come in, running the total up to over $8,000. These include subscriptions per year for five years of the following:

Kewanee Boiler Co., Kewanee, Ill.	$1,000
Sterling Engineering Co., Milwaukee, Wis.	100
Barnes & Jones, Boston, Mass.	200
Aerofin Corporation, Newark, N. J.	100

One of the interesting features of the Boston meeting was the presentation of a three-reel moving picture entitled, "Power," which was presented at one of the morning sessions through the courtesy of Stone and Webster, engineers and contractors of Boston and New York.

These pictures told of man's progress in the development of power from steam, from the first crude piston engine to present-day steam turbines. Many of the developments were made more graphic through the use of animated drawings which visualized the generation of alternating current, the relative importance of water power as compared with coal and similar subjects. The latter part of the film showed a number of power stations in course of construction.

Air Filters in England

Two types of air filters extensively used in England and on the Continent are described in a paper recently read before the Institution of Heating and Ventilating Engineers, in London, by H. W. S. Martin.

The AR type, a unit of which is shown in Fig. 1, consists of a series of perforated aluminum plates placed one behind the other, the plates being covered with wadding, and so arranged that the wadding of each plate is behind the holes of the plate immediately

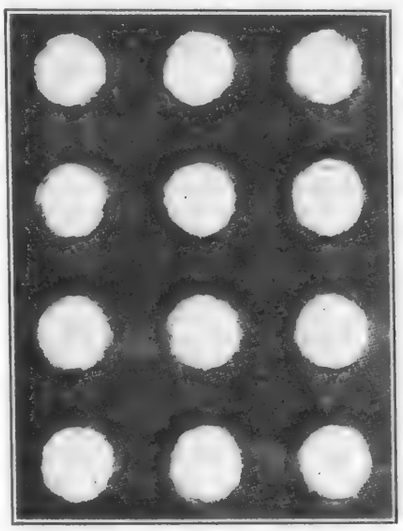


Fig. 1. One of the Perforated Aluminum Plates

in front of it. The air, passing through each hole, (Fig. 2) impinges on the wadding, to which a portion of the dust content sticks, rebounds, and passes through the next rearward hole, and so on through the filter.

It is obvious that the plates nearest the front catch the greatest portion of the dust, and those toward the rear the least. The wadding is chemically treated and made non-inflammable. Cleaning is accomplished by removing the unit and shaking. In this filter the air resistance does not increase with use, as the areas of orifices remain unchanged.

The second type, well represented by the Ventex, a section of which is shown in Fig. 3, depends, for its results, upon the passage of air through a series of baffle plates which have been coated with a viscous fluid, the dust being collected by the sticky surfaces. The accumulation of dirt on the surfaces, it is stated, does not materially increase the resistance of the filter.

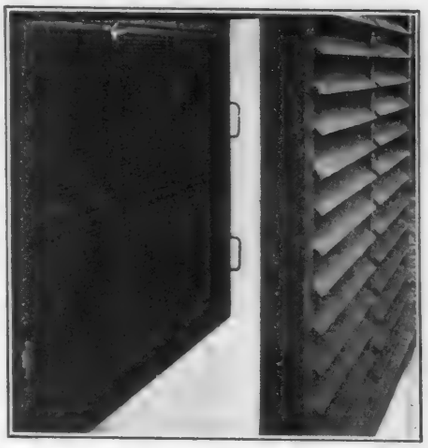


Fig. 3. Ventex Type Air Filter

The units are cleaned by dipping into hot soda water, after which they are again prepared by dipping into the special liquid.

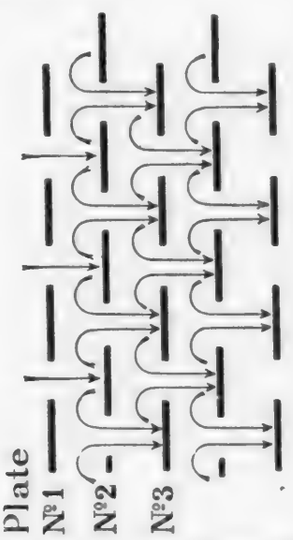


Fig. 2. How Air Passes Through Holes and Impinges on Wadding

Design of AR Type Air Filter

The Heating and Ventilating Magazine's Home-Study Course to be Taken by Detroit Educational Club

Under the direction of John B. Coffey, member of the board of directors of the Detroit Section of the National Master Plumbers' Association, and president of the West Side Educational Club, of Detroit, the home-study course of THE HEATING AND VENTILATING MAGAZINE is to be given at each weekly meeting of the West Side Club. The club membership is comprised of more than 70 heating and plumbing contractors, maintaining showrooms in the Detroit west side. In response to President Coffey's first call on the course more than thirty members responded and joined the class.

The adoption of THE HEATING AND VENTILATING MAGAZINE course is the latest of many educational plans that the club has undertaken since its organization in 1919. A salesmanship course and also a memory course were taken up by the club and other meetings have been addressed by prominent attorneys, advertising men and experts from several manufacturing companies in the industry.

THE HEATING AND VENTILATING MAGAZINE course classes will be conducted by President Coffey, C. W. Locker and others who are specialists in the different phases of the work and the free use of the blackboard is planned, as well as stereopticon slides of the diagrams and layouts in the course.

The adoption of the course is part of a continued policy of President Coffey to utilize every means available to improve the heating knowledge and business efficiency of the club members. In his own business he has given a practical demonstration of the theory he advocates in avoiding unprofitable competitive business and establishing a reputation for competent heating work and service.

In Detroit there are also the East Side, North End, and Downtown Educational Clubs, the membership of each being comprised of heating and plumbing contractors. Each club, including the West Side Club, was organized and is operated for the strictly educational advantages each extends to its members.

The Heating Business For 1925 — How Can We Improve It?

By R. B. Flershem, General Manager Sales. American Radiator Company

(From an address delivered at the annual meeting of the Heating and Piping Contractors' National Association.)

THE building industry has been the leader of general business during the prosperous periods experienced during the past two years. With the immense volume of new construction throughout the country during these years, a large part of the building shortage created by restrictions during the war has been satisfied, and it would therefore appear that during this year the conditions will be somewhat reversed in that the volume of new building construction will depend largely on general business conditions.

The prime factor of general conditions,—available credit,—is all that can be asked. The reserve ratio of the combined Federal Reserve Banks stands to-day within one-tenth of 1% of where it stood a year ago.

FACTORS WHICH CONTRIBUTE TO A HIGHER AMERICAN STANDARD OF LIVING

A résumé of opinions expressed in the public press by leaders of finance and industry and economic research bureaus include the following:

1. World business confidence has been restored through the defeat of radicalism in the recent elections in the United States, Great Britain and France.

2. At home we have an economical government which is recognized as a business man's government.

3. The banking situation is healthy with loans, deposits and reserves in satisfactory relations. Interest rates are low, and the outlook is for only moderate increases. Current rates on four to six months prime paper and bankers' acceptancies during December averaged 3.58 and 2.94, respectively, compared to 4.88 and 4.19, respectively, a year ago. The ratio of loans to deposits at all Federal Reserve Banks is 2½% lower than at the same time a year ago.

4. Production throughout the country has largely increased during the past year, being expressed in manufactured goods in the East, and in larger crops in the West. Steel production has increased from 35% of capacity to 85% thereof during the past six months, and steel ingot production in December was 25% more than a year ago.

5. We have a very profitable foreign business indicated by the fact that the United States trade balance for the month of November,—the last of record,—stood at $198,000,000.00 as compared to $110,000,000.00 in November, 1923. American loans to foreign nations now stand at more than a billion dollars.

6. The buying power of the people in this country has been restored through the rapid rise in grain values with the result that prices of all commodities are nearer their normal exchange value than at any time since 1916.

7. There is a record movement of domestic transportation indicated in the weekly report of total car loadings approximating a million cars a week.

8. Taxes have been reduced and there are prospects of further reductions.

9. There is active employment of labor at good wages.

All of these factors contribute to a higher American standard of living.

WHAT PRESENT CONDITIONS MEAN TO THE HEATING INDUSTRY

This means the quality of building for 1925 will be excellent and the credit conditions will be good.

It means that the heating contractor, on the average, will be promptly paid for his work.

It also means that the best quality of radiators, boilers, valves, regulators and other materials entering into the work of heating installations, and also the best methods of installation should sell in greater volume than ever before.

This means satisfactory profits to those concerns who vigorously and aggressively endeavor to sell quality methods and quality merchandise.

The Architectural Record predicts that the volume of new construction during 1925 will be 10% less than during 1924, but the normal increase of heating installations is somewhat greater than the normal increase in the volume of new building. With this assistance, the heating contractors of the country can do a bigger business than ever before if they will use in the broadest sense vigorous and intelligent salesmanship.

HOW TO CASH IN ON THE "ASK 'EM TO BUY" CAMPAIGN

The *Monthly Service Bulletin* of the National Trade Extension Bureau strikes the keynote in its slogan,—"Want To Sell 'Em? Then Ask 'Em To Buy!" Heating contractors everywhere, large or small, can adopt this motto to their great advantage.

The large contractors specializing in hotels, office buildings, apartment buildings, schools and the like cannot promote increased building, but they can apply force of salesmanship in many ways. For example, they can do more business during the Spring months and thereby reduce the over-time expense during the Fall.

They can sell quality goods and quality methods for their installations.

The best salesman is the owner of the business, and his volume of business and profits will increase if he will spend five or six hours a day away from his office among his prospective customers.

Another suggestion is that when successful in obtaining a contract for heating a school or bank building, or any other similar building where a committee or board of directors makes the award, the contractor determines how the homes of each member of the committee or board of directors are heated, and we do not doubt if he does so that he will always find some excellent prospects for new contracts.

Thus, some business can be created and the rate of total profits can be considerably increased.

The average heating contractor who does ten, fifteen or twenty contract jobs a year, located in both large and small cities, specializes in home heating which constitutes more than one-half of the national building program annually.

In the merchandising of small heating outfits for small homes which started in 1920, there is a great future, and the contractor who looks after this kind of work can become, with good

salesmanship, a real creator of business and a real leader of buying movements.

THE PARTIAL-PAYMENT PLAN

Use the Partial-Payment Plan for small heating outfits for old homes. The financing of new homes is completed before construction is started, including the heating plant. The Partial-Payment Plan, therefore, applies exclusively to the old home. The Partial-Payment Plan is the greatest selling agency ever developed in American industry. Four facts prove this, as follows:—

(a) 90% of all new homes are built on the Partial-Payment Plan.

(b) 85% of all washing machines are bought on the Partial-Payment Plan.

(c) 80% of all furniture is bought on the Partial-Payment Plan.

(d) 70% of the 3,500,000 automobiles sold each year are bought on the Partial-Payment Plan.

The heating industry has already waited too long in availing itself of this powerful selling instrument. Its energetic use by heating contractors will go far to make up for any shortage in new building during the coming year.

In the Spring prices are lowest and you need work for your men. That is the time to be most vigorous in your selling efforts.

Above all, constantly endeavor to sell quality goods and quality methods which bring highest prices, biggest profits, greatest satisfaction and greatest goodwill.

HEATING CONTRACTORS MUST BECOME SALESMEN

To return to the slogan of the *Monthly Service Bulletin*,—"Want to Sell 'Em? Then Ask 'Em to Buy!"

We urge that every heating contractor should pride himself as much on his ability as a salesman as upon his ability as a mechanic. Too many think there is something mysterious about salesmanship, and through timidity fail to do justice to themselves. They feel they can do nothing to change the so-called natural course of their business and thus they hide their light under a bushel.

Too many have the wrong conception of salesmanship, thinking that its essentials consist of good story-telling and entertainment, but salesmanship is merely teaching,—teaching others what you can do for them,—what you have of knowledge or of goods that would be of service to them,—teaching them what they want, and inspiring them to get it.

The real salesmen of the heating industry are the heating contractors. They are the men who make the actual contacts with the final buyers of heating plants. If they, during the coming year, will spend most of their time outside of their shops, looking for business among all possible prospects with the energy, hopefulness and courage born of faith in the high service of their craft, the heating business for the New Year will surpass all expectations of the new building forecast, and there will be an abundance of prosperity and happiness for all.

Safe Oil Burners For Residences

A comprehensive and unbiased discussion of the factors affecting the safety of oil burners installed in residences appears in *The Travelers Standard* for February. The meat of the article is to the effect that such fires as occur are usually due to the use of unapproved burners, or to improper installation; that burners approved by the Underwriters' Laboratories, properly installed and operated, constitute a fire risk that is practically negligible; that proper service, including frequent inspection on the part of the agent is of more importance than initial low cost.

"Domestic oil burners," states the article, "are receiving considerable unfavorable comment at present, from the standpoint of safety, on account of the large number of fires caused by them. For every oil-burning heater in use at present, there are probably a thousand coal-burning installations. It is evident, therefore, that oil burners cause a disproportionately large number of fires, and that present practices in connection with the selection, installation, and operation of these appliances lack some of the necessary elements of safety.

"We believe it is to the interest of manufacturers of such equipment to incorporate all necessary safety devices and appliances and to co-operate with municipal authorities, fire underwriters and others in their efforts to prevent fires from oil burners.

"The average prospective purchaser of oil-burning equipment knows little about the comparative safety of the various appliances that are offered. There are several hundred different kinds on the market, with prices for complete outfits ranging from $100.00 or less, up to $1000.00. There is also a wide difference among the various appliances with respect to safety, economical and satisfactory operation, design, material, and construction.

WORK OF UNDERWRITERS' LABORATORIES

"The task of selecting a safe oil burner has been greatly simplified by the Underwriters' Laboratories. Of the hundreds of different kinds of domestic oil burners on the market today, only about a dozen bear the label which signifies that they have passed the laboratories' tests and have been approved as standard equipment; and the best general advice we can give to those contemplating the purchase of oil burners, is to select one which bears this label. In addition, it is important to give preference to one which is sold by a local dealer who carries a stock of spare parts, and (which is even more essential) who is prepared to keep the equipment in safe and satisfactory operating condition,—because a certain amount of expert attention is necessary with all mechanical devices.

"Having selected and purchased an oil-burning outfit, the owner should make sure that it is properly installed. Since the use of oil burners has become so common, most cities and large towns require house-owners to obtain official permission to install the necessary equipment, and have enacted ordinances for regulating the storage of the oil. Fire-insurance underwriters have also issued rules and recommendations of a similar character, for oil storage. Care should be taken, in all cases, to see that the apparatus that is installed fully complies with these various requirements.

PRECAUTIONS TO BE TAKEN IN INSTALLING OIL-BURNING SYSTEM

"The oil piping in the basement should be installed in such a way that it will not be exposed to external shocks and blows, which might break or loosen the fittings and thus cause leakage of oil. Similar precautions should be taken with the gas piping, when gas pilot-lights are used. When an electric motor is used in connection with an oil-burning outfit, an entirely separate circuit should be installed and used only for this purpose; it may also supply the current for igniting the oil-mixture, if electric ignition is used.

"When oil burners are installed in heating appliances that were originally designed and used for burning coal, the smoke-flues and chimneys should be carefully inspected before starting up the fire.

IMPORTANCE OF PROPER BURNER ADJUSTMENT

"If an oil burner fails to heat the house properly, or is unsatisfactory in other respects, the trouble may be due to the improper adjustment of some part of the burner. The owner should never attempt to make any adjustments himself, because it is likely that he will make matters worse rather than better, and he may even create a dangerous condition. Herein lies the importance, to which we have already referred, of buying the oil-burning equipment from a local dealer who is prepared to give prompt and intelligent maintenance service. In case of trouble or unsatisfactory operation, always call for the service man. It seems to us that the promise of prompt and satisfactory service, and the actual fulfilment of the promise, are among the best sales-arguments that a dealer can use.

FREQUENT INSPECTION URGED OF AUTOMATIC DEVICES

"The automatic action of oil burners has a special appeal for many purchasers. Experience has proved, however, that it is unsafe to rely absolutely on the proper functioning of any automatic device, for an indefinite length of time. Sooner or later the device will fail, and disaster may result. The best oil burners have several automatic devices which are intended to take care of all emergencies that may arise during the regular operation of the burners. These various devices are usually well made and reliable, but they are not (and cannot be) free from the possibility of wear, deterioration, and disarrangement. Therefore they should be inspected frequently, and should receive intelligent care.

"The conclusions to be drawn from what has been said may be summed up as follows: There is a fire hazard associated with oil burners (as there is with heating apparatus of other kinds); the hazard need not be serious if approved appliances are used, and if they are properly installed and receive adequate and intelligent attention; owners should not attempt to make repairs or adjustments, but should have such work done by skilled service men; too much reliance should not be placed upon automatic controlling devices, however good they may be; and if the owner closes up his house and leaves town, but wishes to have the oil burner continue to operate during his absence, he should arrange to have somebody (preferably an experienced service man) come to the house and look over the oil burner at least once a day, and preferably oftener."

Flexibility In Standardization

In a paper recently presented by F. L. Rhodes to the American Engineering Standards Committee, the author, for thirty years connected with standardization work in the Bell Telephone System, strikes a note of interest to every manufacturer.

Briefly, Mr. Rhodes decries rigid standardization, and pleads for flexibility and common sense. He promises to handle standardization as dynamic, not static. Given a standard, he urges, do not force business to conform to it, but change the standard, or so modify it as to reconcile the two. One suggestion, that of standardizing performance requirements of completed things rather than percentages and qualities of components, is worthy of close study. What matter, runs his argument, whether a certain article is made of such-and-such material, produced under rigid specifications, if the performance of the article in service is up to the mark?

Mr. Rhodes opens his paper with a brief account of what happens in Paris when a telephone subscriber experiences trouble. Due to a woeful lack of standardization in the French telephone system, which conditions are on the way to revision, telephoning appears to be "little more than an adventure in a complex of silence and blasphemy."

"In many cases" points out Mr. Rhodes, "it has been our experience that flexibility of production has been obtained and the path to further improvements kept open by specifying, as far as possible, the performance requirements for completed things. An example of this would be specifying the electrical properties of an insulating compound, such as its insulation resistance, dielectric strength and specific inductive capacity, rather than the percentages and grades of different rubbers, oils, waxes and fillers that may enter into its composition.

"Under the plan of specifying results, we have had a number of manufacturers preparing wires under the same specifications. No two of these manufacturers are employing the same insulating compounds in the same proportions, and yet, after a number of years' experience with each of them, we are unable to point out one of these compounds as being distinctly better than the others.

"I should like to emphasize the disadvantages in allowing standards to become so crystallized and set, that their revision becomes a difficult and time-consuming process. Standardization is a useful servant but a bad master. If improperly used, in a rigid, uncompromising way, standardization may fetter progress. If properly used, standardization will be found to be a valuable aid to progress. Whether standardization becomes a hindrance or an aid to progress, will, in my opinion, largely depend upon the degree of flexibility of standards that is maintained, which involves a working arrangement so set up as to facilitate revision, and the full utilization of this arrangement by making revisions whenever this can advantageously be done."

Why Save—Why Not Waste?

One of the tremendously big little accomplishments, so to speak, of the dynamic Secretary of Commerce Herbert Hoover, has just been brought to a focus in the publication, by the Bureau of Standards, of "Simplified Practice—What it Is and What it Offers."

Although but one of an almost infinite number of economic problems being worked out under the direction of Mr. Hoover, the savings already effected run into millions of dollars annually.

The reply to the caption is found in the *finale* of the foreword to this publication, as set down by Mr. Hoover:

"The primary duty of organized society is to enlarge the lives and increase the standards of living of all the people. The whole basis of an increased standard of living, of better human relations, of national progress —indeed, of the advancement of civilization—is the continuous improvement in production and distribution.

"The necessity of maintaining a high-wage level requires that all processes of manufacture and distribution be reduced to the lowest possible cost. This can be done through the elimination of those wastes arising out of too high a degree of diversification in certain products.

"The rate of our advance must be, and will be, in proportion to the extent in which we all co-operate for the elimination of waste."

The academic tenor of this foreword is reversed immediately one begins a study of the results obtained. The publications after outlining the services offered by the division, and the methods of procedure, summarizes, largely by the use of concrete examples, and of graphs, the results obtained. And these specific cases tell the story.

Not many years ago 179 varieties of lamp bases were in process of manufacture, which meant that, if a new bulb were wanted, it was almost necessary to take the socket along to get a fit. To-day 70 manufacturers are producing only six standard bases, which amply cover all requirements.

A clever reflex to the simplification in output was the result of the argument of L. M. Boomer, president of the Waldorf-Astoria Hotel, when he said: "In simplification remember, you are both buyer and seller. If you cannot apply it to the things you sell, apply it to the things you buy." Having given birth to this philosophy, Mr. Boomer proceeded to put it into practice, with the result that he released over a third of a million dollars from inventory, and effected an annual saving of over $100,000. Thirty styles of glassware were reduced to ten, many patterns of carpet to one, and so on, through some 200 items.

One instance cited carries a moral of such vital importance to those who may be only partially "sold" on the idea of simplification that it should be printed in red ink.

"From 1904 to 1914 one store-fixture manufacturer was faced with an up-and-down trend in business. In 1914 he discarded freak varieties and adopted a simplified line. For a period of a year and more there was a decided *decrease in sales.*"

Did this manufacturer get into a panic as the monthly income dwindled, and lose faith in the principle of simplification? Not a bit.. He kept on, with faith.

"His sales began to increase, and in 1921 he finds the annual sales still increasing."

From the graph published to illustrate the sales of this manufacturer, it appears that the rate of increase of sales after the new policy became stabilized was about fourteen times that of the old period.

Many more instances are cited, and the pamphlet closes with a bibliography of nearly two hundred articles covering the results of the introduction of simplification into leading American industries.

This bulletin, "Simplified Practice" may be obtained from the Superintendent of Documents, Government Printing Office, Washington, for ten cents.

THE STATE OF BUSINESS

Situation Very Hopeful

Contradictory Reports Result of Adjustment Over Wide Territory—Careful Production Policies Recommended

Especially Prepared for the THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn Schmidt

A RAPID rise of the economic curve, such as that we have witnessed during the last few months, is always accompanied by the danger of inflation. So there is nothing surprising to read now warnings against pending inflation. Also we may well excuse a leading English financial authority for stating that the rise in the price of the pound sterling is not so much caused by a strengthening of the pound sterling as by a weakening of the purchasing power of the dollar.

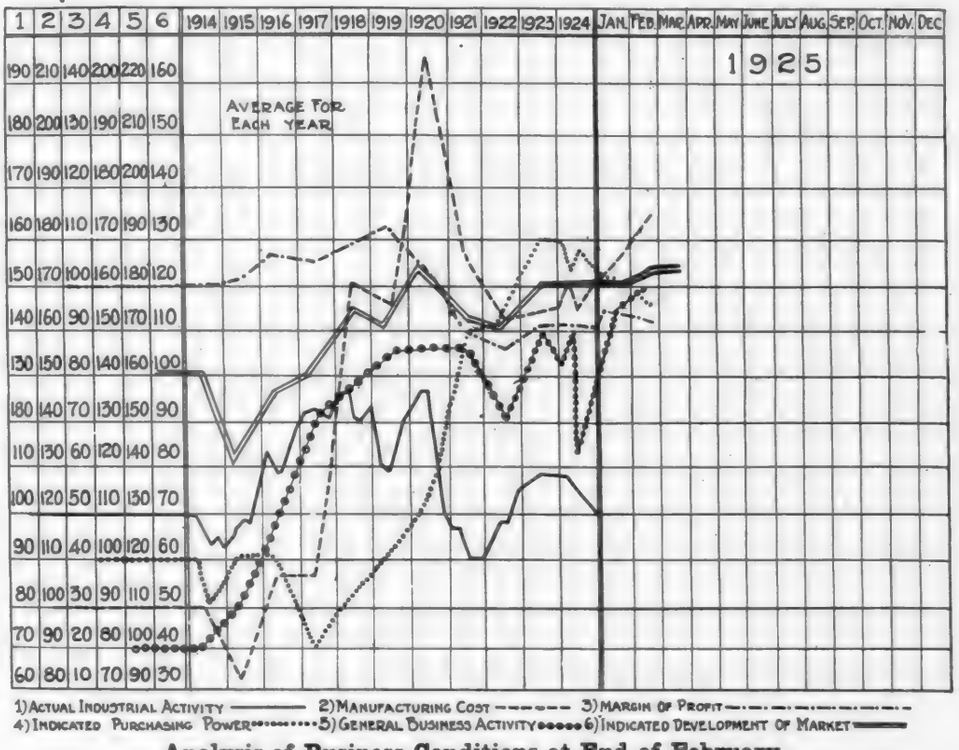
There was a time when the American dollar responded very heavily to every gold movement to and from the United States, making the value of the dollar dependent, not upon conditions in the home market, but upon the international financial situation. Since the war this has changed. The changes of the value of the dollar belong in the realm of domestic economics. The United States apparently has acquired all the gold needed for its business. There has been no perceptible stringency of the money supply. This necessarily does not mean that the credit situation has been uniformly good. In fact merchants complain about lack of fluid credits at this very moment when the outlook seems so bright.

It is this special feature of the situation which is of particular importance to the student of the situation of the market. You cannot have both inflation and frozen credits at one and the same time. Always letting alone the stock exchanges which seem to move upon a plane entirely their own, only faintly connected with actual industrial conditions, there is no tangible evidence of either credit or industrial inflation. This is due in part to the conservative credit policy followed by the banks and in part also to the fact that there has been little industrial expansion during last year.

True, building activities have been heavy, but these have run principally into dwellings, while industrial buildings have not exceeded the normal annual requirements. The sudden increase in employment figures also should not be quoted justly for evidence of present or near inflation. This increase by no means can be called exceptional.

The labor market has been dull, to say the least, all through the second half of last year, with a corresponding decrease of industrial production. If employment rises now the product of this new labor must neutralize the effect of six months' lessened production first before it can equalize the ratio of production and national consumption, and only after this point of equalization is reached and exceeded may we talk of industrial inflation.

And what about prices? All standard price indexes record a general advance of commodity prices. The upward adjustment is not always due entirely to higher costs of production but also to the wish of manufacturer and dealer alike to cash in for once after a lean period. This desire is only


1 2 3 4 5 6
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC.
1925
AVERAGE FOR EACH YEAR
1) ACTUAL INDUSTRIAL ACTIVITY
2) MANUFACTURING COST
3) MARGIN OF PROFIT
4) INDICATED PURCHASING POWER
5) GENERAL BUSINESS ACTIVITY
6) INDICATED DEVELOPMENT OF MARKET

Analysis of Business Conditions at End of February

natural but its wisdom must be doubted. Just now no harm is done by such a flurry. A few weeks' trial will soon show whether the consumer is willing to foot the bill or whether he will shut down again in the face of higher prices. We are inclined to say that he will not be willing to pay any price asked and that by doing so he will do more to prevent inflation than any other agency, governmental, financial or economic. The law of supply and demand has not been abrogated yet.

From all this it appears that the danger of inflation, while of course always present in a market like this, is still sufficiently remote as not to cause any serious concern. A little care will prevent it.

But we are nearing a more serious test of the soundness of the present economic situation.

Reports from the retail trading centers are very undecided. While some retail branches report very active business others complain. All the so-called luxury trades have noticed a slump, immediately following the very active Christmas trade. The question is now, how will the farmer come through the Spring season? Most farming communities, after having undergone a short period of plenty, have realized by now that high wheat prices by themselves are not a cure of all agricultural ills. Instead of continuing their policy of free buying they have settled down again to the more sedate but very useful employment of conserving their resources for the coming Spring purchases. While this has curtailed somewhat commercial transactions in the West and Middle West it holds, on the other hand, the promise of a further sound development of the market after once the Spring needs have been covered.

This and other market evidence appears all very contradictory but it is all the result of the national business trying to find its sea legs. We must naturally pass a period of readjustments and temporary expedients before we can expect complete normalcy of the market. The extent of this period depends very much upon how the situation is handled by banks, manufacturers and dealers.

Taking into consideration, therefore, the general soundness of the economic foundation of the market we have reason to expect that the normalization of business will be completed before the end of the Spring. By that time the market should be cleared of all the encumbrances of last year's depression. As retail stocks are low we predict a slow but steady upward movement in the demand of merchandise of all character. It must now be the duty of the industry to regulate the supply in conformity with the demand so as to eliminate the danger of overproduction which under the present conditions might easily force prices down below the real value of the product.

New Apparatus and Appliances

Development of the Dunham Regulating Plate

Dunham regulating plates are to be installed in all future Dunham heating systems, according to an announcement of the C. A. Dunham Co., Chicago, Ill. This device is, essentially, a metal disc, as shown in Fig. 1, having a central orifice properly proportioned to the radiator with which it will be used. Fig. 2 shows the disc as installed in the valve. To prevent error, each disc is stamped with the square foot surface of the radiator for which it is designed.

An ideal home heating system, of course, is one which will supply heat to each room at the same rate that each gives off heat to the outside. It should also keep each room constantly at the desired temperature, and, in a so-called vapor system the radiator farthest from the source of vapor supply, should receive its proportion of heat as readily as the ones close up.

By properly proportioning the area through which vapor flows into each radiator, it is not only possible to secure favorable temperature regulation but, to secure a uniform distribution of the available heat throughout each and every radiator.

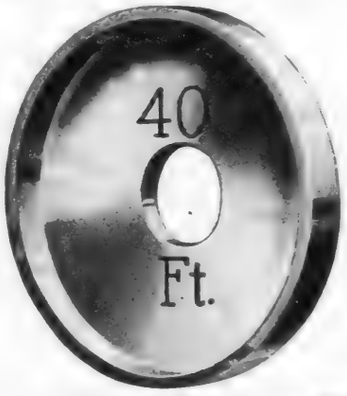


Fig. 1. Dunham Regulating Plate

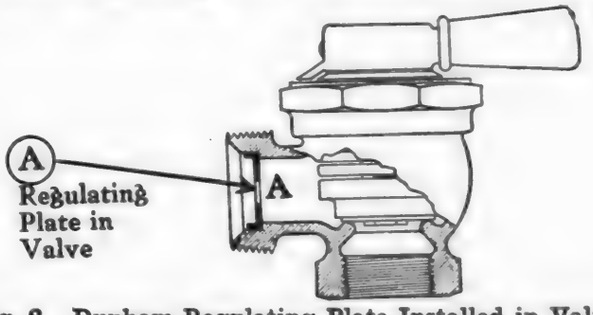


Fig. 2. Dunham Regulating Plate Installed in Valve

Consider a radiator where the inlet valve is installed at the top. A ¾ in. valve would be used on radiators varying from 26 sq. ft. to 100 sq. ft. in size, inclusive. It is evident that the opening provided for the flow of steam into the 26 sq. ft. radiator is proportionately four times larger than that provided for the steam supply to the 100 sq. ft. radiator. If a system is full of steam and all the conditions are as assumed when designing the system, both the 26 sq. ft. and the 100 sq. ft. radiator will fill full of steam vapor and give off the quantity of heat they are supposed to give off.

Under ideal conditions the 26 sq. ft. radiator should heat no more rapidly than the 100 sq. ft. radiator, irrespective of the relative location of the two with reference to the boiler.

In actual practice, however, if the pressure should drop below that required to entirely fill the system, one radiator may take more than its proportional share of steam, even though that radiator is located so that its flow resistance from the boiler is the same as in other radiators; under such conditions the full radiator would overheat the room whereas the other radiators being but partially filled would underheat the respective rooms for which they were designed.

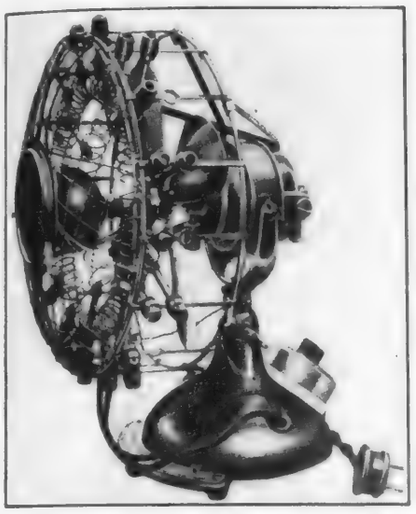
During the milder days there are times when a radiator should give off only a fraction of the heat required under cold weather conditions. To secure this result, a lower vapor pressure is often carried on the steam main but the tendency in such cases in a vapor system is for the radiators closest to the boiler to take more than their proportion of the vapor, and thus prevent sufficient vapor from reaching the radiators in portions of the building remote from the boiler.

This is a condition which the Dunham regulating plate is designed to overcome. Through the use of the regulating plate it is possible to control the steam vapor flow to each radiator so that the flow will be only that which can pass through the given size orifice.

The regulating plate is also designed to distribute the steam vapor uniformly under every pressure condition. In this way it is possible to effect an increased operating economy and tendency to uniform regulation of the temperature by variation of steam pressure.

Portable Electric Fan With Heating Element

Are the English ahead of their Yankee cousins in making full use of their portable electric fans throughout the entire year? The illustration shows a fan, manufactured by John Grundy, Ltd., 393 City Rd., London, E. C. 1., England, which is provided with heating coils through which the air is blown. It is claimed that a room may be more quickly and economically heated with this fan than by the use of radiators. There is also a light bulb fixed in the center of the fan; bulb, heater and fan being controlled by a single switch.



Portable Electric Fan Equipped With Heating Element

Heater, Fan and Lamp Controlled by One Rotary Switch

Johnson Dual Thermostat

The necessity of maintaining a portion of the rooms of a public building at normal day temperature while the remainder of the building is "banked" for the night, such as obtains in schools holding night classes, has been met by the Johnson Service Company, Milwaukee, Wis., with a very ingenious development of the Johnson pneumatic system.

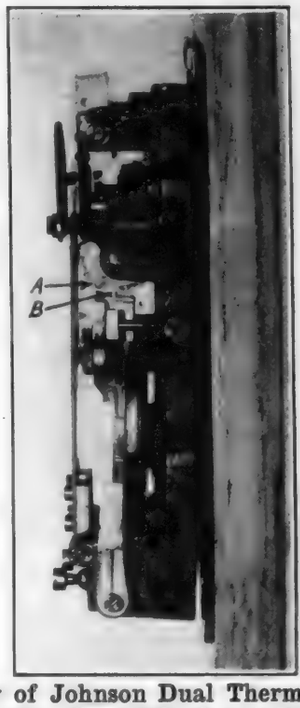
The first demand for such control was made by the public schools in New York City, where evening classes form an important part of the school activities. In buildings of this size it would be practically impossible to handle the situation manually; that is, by individually adjusting the controls in such rooms as might be required for evening classes after the regular day sessions. It also meant a second circuit of the building in the morning to return the thermostats to normal, with the probability that the accurate working of the thermostat would be impaired through careless setting.

At first it was proposed to section the heating lines when the piping was designed, so that certain portions could be cut off with valves. This plan failed because the arrangement was too rigid, permitting of no deviation in the groups of rooms to be used; also the initial cost was greatly increased.

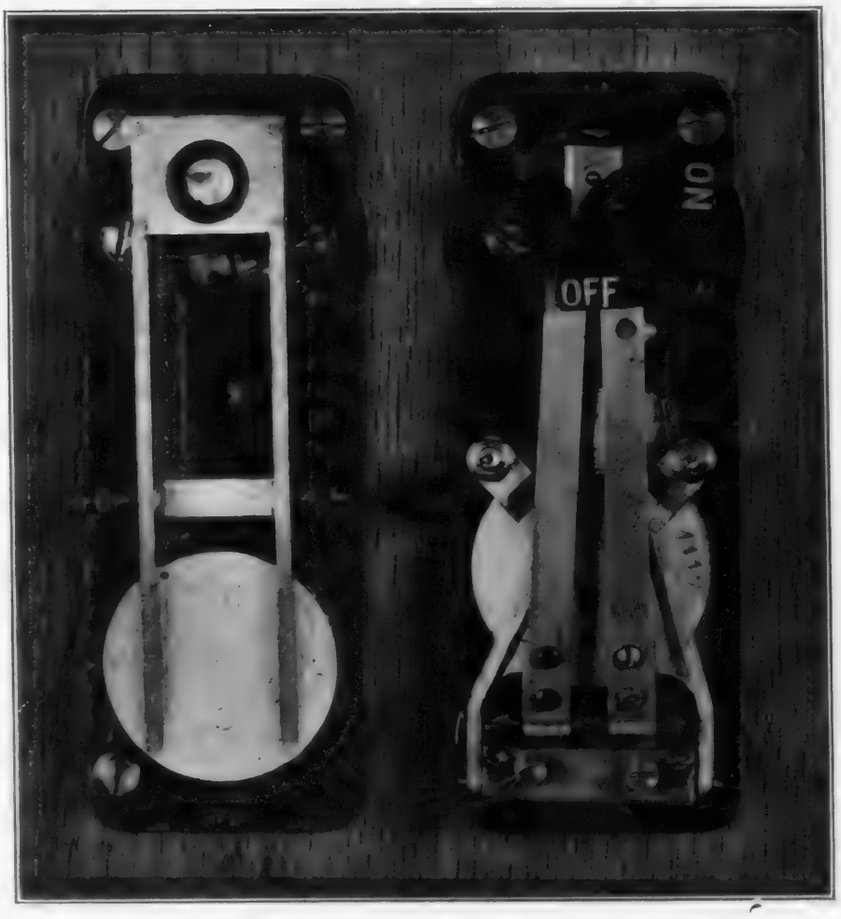
The Johnson control for such purposes consists of a thermostat with two thermostatic strips, either of which, through the pneumatic tubes, is arranged to cause proper functioning of the heat sources. It remains, then, to devise a method of throwing the thermostat functioning to either of these strips from a central point, and transferring to the other strip again at will.

In the illustration there will be seen a small cam wheel (A), fixed to the same shaft with a ratchet wheel which is not visible. The ratchet wheel may be rotated a certain degree by the movement of the plunger (B), carrying with it the cam wheel. When the thermostat control dial is set at "off", the instrument functions in a normal manner, holding the heat at, say 70° continuously. If the dial is turned to "on", however, the cam and ratchet wheel mechanism is permitted to function.

In this condition, at the close of the regular school session the engineer simply presses a button. This causes the



View of Johnson Dual Thermostat Showing Cam Wheel and Mechanism for Changing from Day to Night Service



The New Johnson Dual Thermostat

normal air pressure of 15 lbs. to be momentarily removed from the system, the release of the air pressure from all thermostats that have been turned to "on", causing the plunger (B) to push the ratchet cam wheel through a portion of a revolution, changing the control of the thermostat from the "day" to the "night" strip. The thermostats that have not been set to "on" are not affected, and continue to function as usual. The rooms not wanted for the evening are allowed to drop to, say, 40°.

In the morning the button is again pressed, the release of the air pressure causes the plunger to again move the ratchet-cam wheel, and control of such thermostats as have been working on the "night" strip is transferred again to the "day" strip.

It is readily seen that, with such an installation the flexibility is 100%, as any single room or group of rooms in any part of a building may be made to conform to any program of use.

A further refinement consists in the addition of a third thermostat element, so connected that, at the close of the evening sessions, the pressure of the button will permit whatever vapor is then available in the system, to be distributed throughout the building as a whole, thus providing an additional preventive against freezing of toilet or cold water pipes, and making the best use of heat that would otherwise be confined to only a portion of the building.

The Johnson Service Company is preparing a supplement to its regular book on temperature and humidity control, covering dual control.

New Barber Jet Gas Burners

A jet gas burner that is being placed upon the market by The Cleveland Gas Burner and Appliance Co., Cleveland, O., is interesting in that it appears to overcome some of the difficulties experienced with this type of burner. Some four years of experimentation have produced a burner which, it is claimed, besides being economical, will develop a flame temperature of from 1,950° F. to 2,020° F. on artificial, natural or mixed gas; that will not back-fire or deposit carbon, regardless of pressure; that will produce a perfect orange-green flame with any fuel, and that will require no adjustment jets, it is further pointed out, cannot to meet changing conditions. The become clogged or corroded or effected by condensation, and may be turned almost to a point of extinction and still function. They also act as their own pilot light.

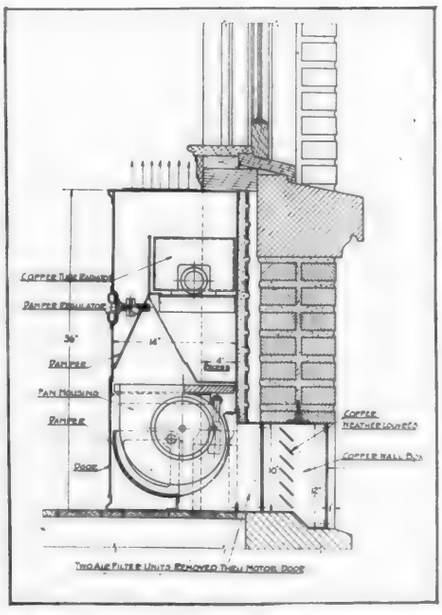
New Trade Publications

ILLINOIS MALLEABLE IRON CO.'S new general catalogue has been issued. The catalogue covers the company's full line of malleable and cast-iron pipe fittings, iron-body gate valves, brass valves, house heating boilers, tank heaters. The chapter devoted to Imco sectional heating boilers gives full details regarding both the steam and water type for both the sectional and round boilers. An index is included making is easy to refer to the different products. Size 6-in. x 9½-in. pp. 129.

HOFFBLO SYSTEM for the utilization of low-grade coal is small steam, water or air furnace, is described in a folder received from the Hoffman Combustion Engineering Co., Detroit, Mich. It consists of a blower controlled through a thermostat, for providing the necessary air. A special tuyere arrangement can be furnished where screenings, coke breeze or slack are to be burned. The same company makes the Hoffman grate, designed for use with a blower, to produce complete combustion of screenings and other low grade fuels, in larger boiler units.

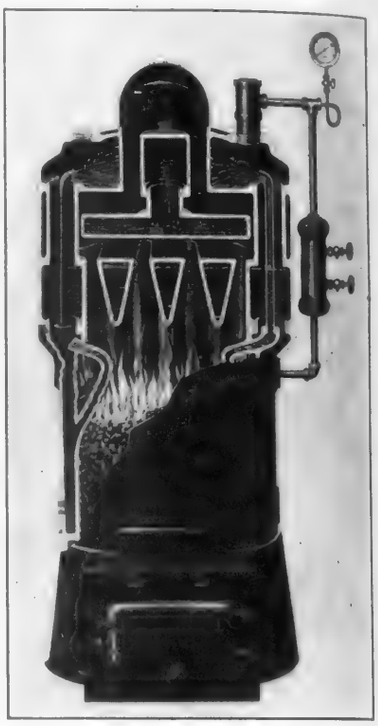
PARTIAL LIST OF INSTALLATIONS OF THE UNIVERSAL UNIT VENTILATION SYSTEM, is the title of an attractive booklet issued by John J. Nesbitt, Inc., Atlantic City, N. J.

A comprehensive list of architects is given with the various buildings, practically all schools, designed by them, in which Universal units have been installed. The pamphlet is replete with full-page illustrations of the larger Universal unit-equipped buildings, and concludes with an impressive assortment of letters from satisfied users.



Latest Construction of Universal Unit Ventilator

BOYNTON PERCO BOILER, which is the new trade name for the Percoplate boiler as redesigned by Charles B. Boynton, is the subject of a circular received from the Perco Heater Corp., 671 Broad St., Newark, N. J. It will be seen from the illustration that the



Design of Boynton Perco Boiler

design, as worked out by Mr. Boynton, provides for separating a small quantity of water in the fire-pot section, raising it in tubes through a positive geyser action to the upper steaming heads, where it is discharged to thinly cover the floors of the steaming surfaces.

By this means, it is possible to generate steam in five minutes from the time of lighting the fire. In addition, it is claimed, there also results a material saving in fuel. Mr. Boynton has concentrated the results of 30 years of heating appliance development into the design of a boiler of this type that would eliminate thin water passages, small cast-iron water tubes, and geyser design, resulting in surging, priming and restricted water circulation. Of prime importance, also, was the necessity for keeping the design simple so that initial cost could be kept low.

Boynton Perco boilers are listed in eight sizes for steam, from 325 sq. ft. to 1,200 sq. ft. and in the same number of water sizes, rating from 525 sq. ft. to 1,850 sq. ft.

O. E. FRANK HEATER & ENGINEERING CO., INC., BUFFALO, N. Y., HEATERS, CONDENSERS, COOLERS, EXCHANGERS is the name of Bulletin No. 25 issued by this company. In it are described and illustrated (with tables), instantaneous heaters, floating head heaters for feed water, domestic service and swimming pools, and forced and gravity

water heating systems. The shells are wrought-iron, cast-iron, or steel as required by the service, the tubes being of sheet steel or Muntz metal and the tubes Admiralty metal.

APEX CO_2 RECORDER is described and illustrated in literature issued by Uehling Instrument Co., Paterson, N. J. This instrument is both indicating and recording, and uses cartridges of natron, which is described as an ideal dry material for absorbing CO_2. By the lowered production and selling costs following quantity production it has been possible to put the Apex on the market at a price that is attractive to owners of boilers down to 50 h.p.

FITZGIBBONS-ONTARIO BOILER for low pressure steam and water heating is bulletined by the Fitz-Gibbons Boiler Co., Inc., New York. This boiler is built throughout of certified steel, conforming to A. S. M. E. and State code requirements. Ratings and specifications are given in the bulletin for ten sizes ranging from 400 to 1,800 sq. ft. steam rating and from 700 to 2,900 sq. ft. water rating.

PYRAMID GRATE, for burning the smaller sizes of coal, is described in a circular issued by the Pyramid Iron Products Corporation, 136 Liberty Street, New York. In conventional grate bar design, the vertical openings are, of necessity, of a size to conform to the grade of coal to be burned—the smaller the coal, the closer the bars. The result is that grates designed for the smallest (and cheapest) sizes, are set so close that restriction of air flow results, reducing combustion to points of low economy.

The Pyramid grate differs both in principle and design from the old type. The air passages are vertical only through the lower part of the grate, the air impinging upon the lower sides of the flattened pyramids that constitute the upper portion of the grate, deflecting to the horizontal, and emerging from four openings with a swirling motion. This arrangement is intended to give a uniform distribution of air throughout the entire area of the fire.

Design of Air Ducts in Pyramid Grate Showing How Size of Air Uptakes is Not Dependent Upon Size of Coal

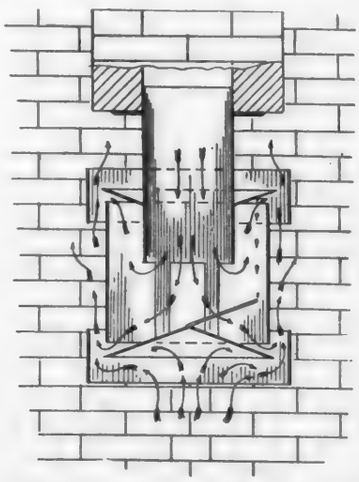
It will be seen that the size of the air uptakes is not in any way dependent upon the size of the coal to be burned; as a matter of fact they are standard for all sizes. The design of the air ducts is such that the areas at the grate surface are greater than at the lower, preventing any tendency to choke. It is stated that the air space is 30% of the total grate area.

Another interesting feature of the grate is the fact that warpage is almost entirely eliminated due to the fact that cold air is constantly flowing across the lower faces of the pyramids keeping the hottest portions, the tops, at a minimum temperature. Coal of the smallest sizes, down to screenings, sawdust, and lignites, may be burned with practically no loss of combustible with the ash, and with high efficiency.

Pyramid grates are manufactured in both stationary and dumping types, standard stationary units being 6 in. wide, and dumping units 6 in. and 12 in.

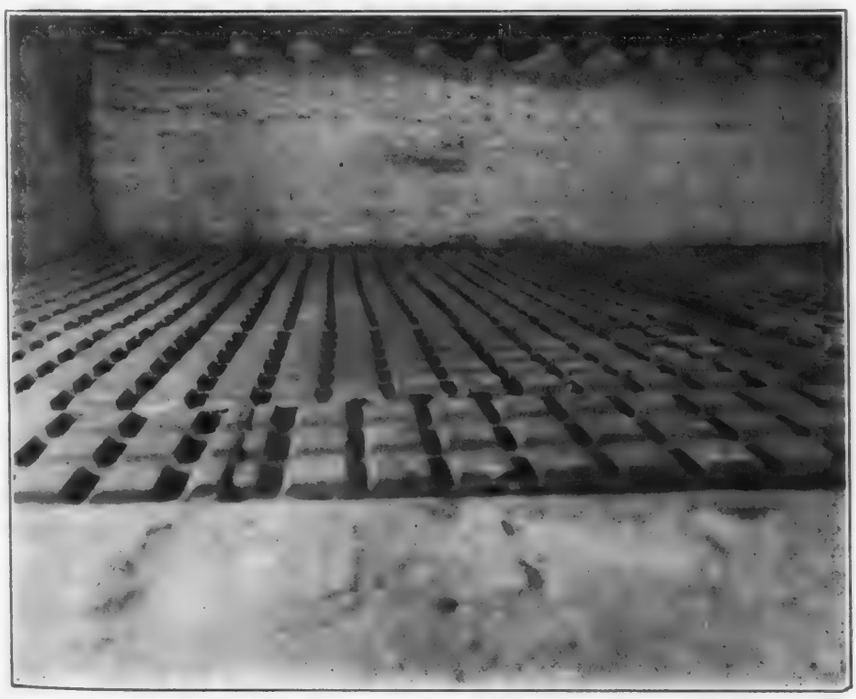
COLUMBIA STRIP CHART RECORDER is described and priced in Bulletin 1,700 of American Schaeffer & Budenberg Corporation, Brooklyn, N. Y. This recorder is designed for applications where is is desirable to obtain a record of temperatures or pressures over an extended period of time, and where the cycles of operation are of relatively short duration, requiring a wide, open record, enabling detection and study of the slightest variations.

BRASSINGTON VACUUM CAP, designed to provide positive draft under any wind conditions, is described in a folder issued by A. F. Brassington, 520 West 41st St., New York. It is stated that with this device on a chimney so close to a wall that wind pressure may at



Air Flow Through Brassington Vacuum Cap

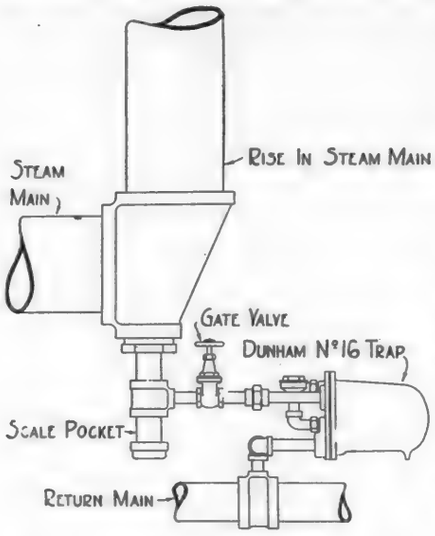
times be directly down upon the cap, it will prevent a back draft in the chimney. The total area of the exit slits is over twice the area of the base connection. When the wind impinges on the cap, as shown in the illustration, the air compressed on the upper disc is confined by the surrounding band, and is forced over the edge of the disc, expanding, and causing a suction on the annular opening. On the lower end the air is forced past the slit, causing it to draw from the drum at the same time as the air is drawn from the upper end. Water collecting on the top disc is drained off through a small pipe.



Typical Installation of Pyramid Grate

KELLY ROCKING GRATES, with a novel arrangement to limit the opening between grates to the regular air opening, are described in a booklet received from Poe Co., Detroit, Mich. The basis of the Kelly argument is that cleaning grates through the fire doors is wrong, and that an economy of at least 10% will result from the installation of Kelly dumping grates.

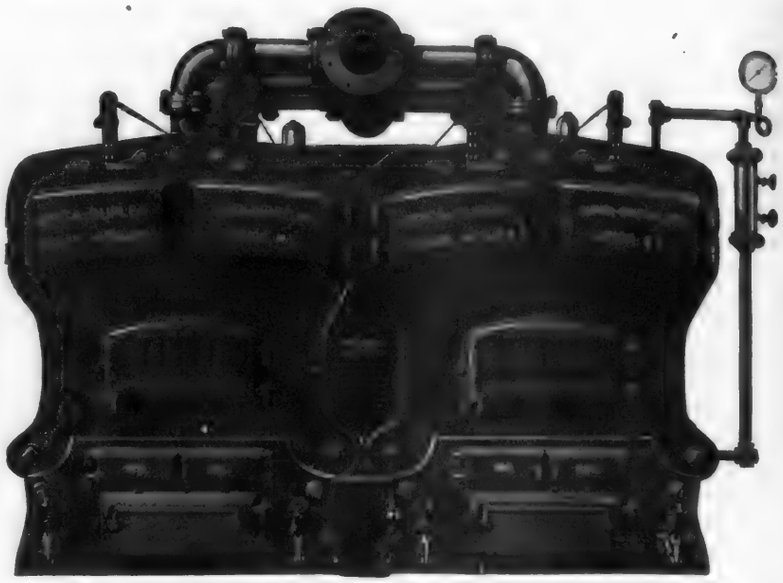
DUNHAM FLOAT AND THERMOSTATIC TRAPS in two new sizes (Nos. 22 and 23) are described in a late bulletin received from the C. A. Dunham Co., Chicago, Ill. These traps, which may be applied to any type or make of cast-iron or pipe-coil blast heaters, are



Method of Connecting Dunham Float and Thermostatic Trap to Rise in Steam Mains

similar to the No. 16 trap for handling large volumes of water, but are of smaller capacity, being rated at from 3,000 to 4,000 sq. ft. of radiation, respectively. They are described as especially useful for dripping large low-pressure steam mains and risers. The accompanying illustration shows the method of connecting the trap to rise in steam mains.

STRUCTOLITE HOMES is the title of an attractive booklet issued by United States Gypsum Co., Chicago. Structolite is a form of gypsum developed by this company in 1916, and the publication in question describes the use of this material used as a binder, with cinders, slag, crushed stone, gravel, and, frequently sand, to produce Structolite concrete, for both exterior and interior walls and floors. Insulation tests made at Columbia University are quoted to show the superiority of Structolite concrete over Portland cement concrete brick, and frame construction. Other factors, such as permanence, economy, and soundproof qualities are covered. There are several pages of wall, floor, and opening details, and chimney construction, together with a brief outline of methods of handling. Compression, freezing and fire tests are quoted, and detailed specifications for Structolite concrete given. Size 8½ x 11-in., pp. 16.



Unit Front Plate of Utica-Duplex Super-Smokeless Boiler

UTICA - DUPLEX SUPER - SMOKELESS BOILERS, now available in units up to 25,000 sq. ft. steam and 40,000 sq. ft. water ratings, are described and dimensioned in a new folder of the Utica Heater Company, Utica, N. Y. As the name suggests, these new units are the result of duplexing the smaller super-smokeless boilers that have been built by the Utica Heater Company for several years past.

In the new boilers the air-blast feature is retained, and two separate grates are used, with a water leg between, making it possible to stoke or clean either grate without in any way disturbing the other. A single front plate to the boiler conveys the suggestion of a single unit and the installation could not be considered in any way a piping together of two small boilers to obtain the required capacity.

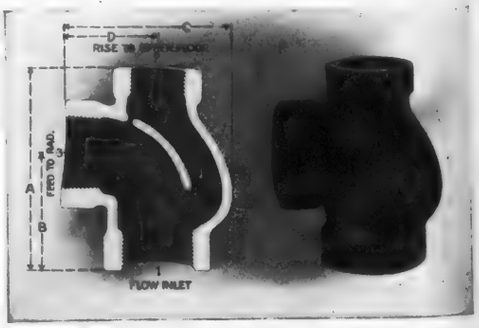
A large cast-iron header connected by flanged fittings connects the two halves of the unit, providing exceptional steam space. Arrangements are made for equalization, and a steady and low water-line is assured.

The bulletin lists with essential data, twelve sizes, the smallest rating 8,500 sq. ft. steam and 13,600 sq. ft. water.

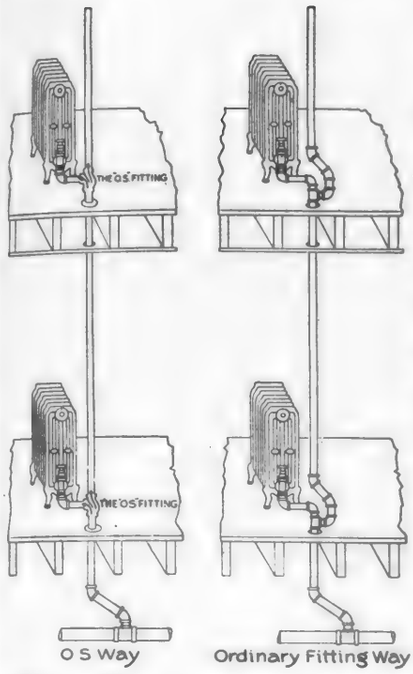
HERE'S HOW THE AUTOFORCE WORKS, is the name of a post-card folder sent out by the B. F. Sturtevant Co., Boston, Mass. "Autoforce" is a ventilator based on the principle of a cone creating a vacuum by causing the air to flow through a passage which leads up from the space to be ventilated. It is said that all possibility of a down draft is eliminated by a vane which keeps the ventilator headed into the wind at all times.

GIANT RADIATOR HANGERS, of an improved type, are presented in a folder recently issued by the Western Hanger Company, San Francisco, Calif. The appliance is built in two types; one for the legless radiator and another for the wall design. Each model is constructed of malleable iron and provided with both horizontal and vertical adjustments. The advantage of the hanger's design lies in the fact that it is invisible when the radiator is in position. The anchor-bolts may be set in the wall during the construction of the building and the radiators hung and tested before floors are laid. Shipping weight is 2½ lbs. for the wall radia- merged and is water lubricated. A monel metal valve and seat is used for high and intermediate pressures and a bronze valve and seat for low pressures. When closing, the valve rotates on its seat for self-grinding. Parts are interchangeable.

O. S. DISTRIBUTOR FITTINGS, designed to prevent short circuiting of hot water, and so to control the circulation that uniform distribution to all radiators may be had, are the subject of a recent folder issued by the Groeniger Mfg. Co., Columbus, O. The fittings are listed and priced in sizes from ½ in. to 2½ in., inlet, with many variations of outlets. These fittings are designed to save labor in installation, as they do not require additional fittings, and



Construction of O. S. Distributor Fitting



Installation of O. S. Fittings Compared with Ordinary Fittings

make it possible to keep risers in line. They are furnished in cast-iron, galvanized, or all brass.

KEWANEE FIREBOX BOILERS AND TABASCO WATER HEATERS, TANKS, WATER HEATING GARBAGE BURNERS, as well as the company's line of cast-iron radiators, are presented in General Catalog No. 80, just issued by the Kewanee Boiler Co., Kewanee, Ill. The catalog contains all the necessary data, including ratings, setting measurements, etc., for selecting each type of Kewanee boiler, including the smokeless type, brick-set type for heating, smokeless portable type, up-draft portable type, smokeless portable Type K and up-draft portable Type K. Similar data are given for the Kewanee power boilers. Size 8½ x 10¾. Pp. 24 (punched for binding).

CROWN FUEL SAVERS are discussed in a recent folder issued by the Crown Fuel Saver Co., Richmond, Ind. The Crown Fuel Saver is a gray-iron casting made to fit the feed door of the boiler or heating plant and by action of the natural draft is used to provide the hot air (oxygen) necessary to burn the gases and smoke that arises from the fuel bed.

NOW YOU CAN EVENHEAT YOUR HOME is the title given one of the latest folders issued by the Evenheat Mfg. Co., Chicago, Ill. It features the Evenheat boiler which is described as having a roomy combustion chamber, reversible flue, free water circulation, provision for ease and safety of operation and arranged to utilize fully the hot gases. The company also publishes a folder describing its garage heating unit which comprises a gas burner and radiator.

New Books

TULLY'S HANDBOOK OF ENGINEERING is a voluminous treatise on power plant engineering in three volumes. Its purpose is to supply information that is understandable to the fireman and stoker, desiring to progress, as well as to the chief engineer and plant superintendent. There are more than 1200 subjects covered and many tables shortening computations. The first volume deals mainly with boilers and their accessories; the second with prime movers and the necessary adjuncts, and the third with electric generators, motors, refrigerating, ice making, and air compressing machinery, meters for all purposes, internal combustion engines, heating and ventilating and miscellaneous matters. Tully's Handbook is in three volumes, aggregating 1,155 pages with 543 illustrations, and is published by the McGraw-Hill Book Co., New York.

STEAM POWER PLANT ENGINEERING, by Gebhardt, has just been announced in the sixth edition, by John Wiley & Sons, Inc., New York. Nearly 40,000 copies of this book have been sold, and the new edition was necessitated by the new material available. Size 6x9 in., Pp. 1012, with 714 figures. Cloth, $6.00, post paid.

MANUAL FOR ENGINEERS, has just appeared in its 26th edition, published by the University of Tennessee, Knoxville, Tenn. Correction of errors, revision of subject matter, selection of new material has constantly been going on throughout these 26 editions and it is felt by its publishers that this manual has reached a very high state of correctness, variety of matter and all laid-out in an excellent manner. There is a large amount of tabular data, arranged in convenient form to be easily available.

New Publications

ASSOCIATION, EDUCATION, LEGISLATION AND STANDARDIZATION are discusstion and STANDARDIZATION are discussed in a recent publication by the Heating and Piping Contractors National Association. The opening Section deals with the origin of the association, the need of getting together and the ideals and accomplishments of the *Official Bulletin*. Information is given on estimating, bidding through general contractors, relations with jobber and manufacturer and patent infringements. There is also a discussion of the standardization of flanges. flange fittings, standard methods for rating low-pressure boilers, sales to consumers and standard contract forms.

SPECIFICATIONS FOR CONSTRUCTING AND OPERATING HEAT-TRANSMISSION APPARATUS FOR TESTING HEAT-INSULATING VALUE OF FABRICS is the title of Technological Paper of the Bureau of Standards, No. 269. This paper, by P. D. Sale, contains information of value to those interested in textile testing; contains detailed bill of material and full working drawings for the construction of apparatus similar to that used in the Bureau of Standards, together with instructions for its use, and a typical example, worked out in full detail. Copies may be obtained from the Government Printing Office, Washington, for 10 cents each.

SALES BULLETIN, devoted to creative ideas in selling gas and electricity and their appliances, is a new periodical issued by the Illinois Power and Light Corp., Chicago, Ill. The object of this monthly is also to advance the merchandising department of the company. It will completely cover from month to month the entire field in the company's sales activities, throughout its territory.

BULLETIN OF THE NATIONAL DISTRICT HEATING ASSOCIATION, for January, 1925, contains the call for the association's sixteenth annual convention, which will be held at the West Baden Springs Hotel, West Baden, Ind., May 19–22, 1925.

The tentative program, in addition to reports from officers and committees, includes addresses by C. H. Berry, Professor J. D. Hoffman, Purdue University; Earle Shultz, past president, Building Managers' Association; L. W. Wallace, Department of the Interior; L. E. Young, Union Electric Light & Power Co., St. Louis, Mo., and A. C. Marshall, vice president and manager, Detroit Edison Company.

Clyde A. Mann, of the Bureau of Industrial Research, Chicago, is the author of a very readable article "Why Heat Leaves Home," reprinted from the December *Kiwanis Magazine*. It covers the subject of the amazing and apparently ignored heat waste in practically every home in America, and touches on ways and means for bringing about better conditions.

Earle Shultz, vice president, Illinois Maintenance Company, Chicago, presents an exhaustive analysis of the many factors in the controversy between advocates of central station service and those of isolated plant operation, drawing the following conclusions:

"1. In the older and less efficient plants, now operating it would be extremely profitable for them to take central station service.

"2. In the newer and more efficient plants, the value of central station service would depend upon the amount of labor which could be saved in their plants; and on the price of coal and labor.

"3. All new buildings would make a decided saving by taking central station service, thus avoiding the investment charges which an isolated plant would entail.

"4. As the cost of coal and labor increases, central station service becomes more and more profitable to the building.

"5. As the central station rates for electricity decrease, central station service becomes more profitable to office buildings."

Heating and Ventilating Magazine, March, 1925

How To Heat Your Home

(This is the sixth of a series of articles giving practical information of fuels and furnaces.)

VI. How to Burn Gas

By Samuel S. Wyer

Associate in Mineral Technology, U. S. Smithsonian Institution. (Science Service)

MANUFACTURED gas is man-made by "transmutation of crude dirty inert coal into energetic gas." Natural gas is made by Nature and is transmitted to the consumer in its natural state. The heating value of natural gas is about twice that of manufactured gas. That is, it takes 2 cu. ft. of manufactured gas to furnish the heating energy of 1 cu. ft. of natural gas. Because of its higher heating value, natural gas requires twice as much air for combustion as is required by manufactured gas, otherwise the two gases are handled just the same in the home appliance. Natural gas does not have a distinctive offensive odor like manufactured gas, and this makes the detection of natural gas leaks in the home more difficult. The flame temperature of the two gases are practically the same.

Large volumes of gas, to be burned, must have some of the air mixed with the gas before the gas reaches the flame. In Bunsen or blue-flame burners, the air is sucked into the mixer by the aspirating action of the gas. The air shutter must be adjusted until a clean blue flame is produced. A yellow flame with this type of burner is an indication of waste.

Small volumes of gas forced out through a small hole, about the diameter of a pin, can get enough air to insure perfect combustion with a yellow flame. This type, known as the luminous-flame burner, can be used only for room heating purposes and then only in positions where the flames do not impinge on each other or on any surface.

Natural gas appliances should always be adjusted for low pressure only, and only low pressures of 1 to 2 oz. used. This would save gas and give better service during the inevitable low-pressure conditions when the demand is greater than the available supply.

Even with perfect combustion, it is not desirable to have carbon dioxide and water vapor, that must always be formed, remain in the room. If the burners are not correctly adjusted, if something goes wrong so that the heater begins to generate carbon monoxide gas, which is a poison, the use of adequate flues is a good insurance against accident.

RULES FOR CORRECT GAS USE

1. Blue-flame burners must be properly adjusted and burn blue only.
2. The inner cone of the blue flame must not strike any surface.
3. The flame on "luminous-flame" heaters must not strike each other or any surface.
4. Flues should be used on all water heaters and room heaters used continuously.
5. Never use gas in any coal-burning appliance; it will always be wasteful.
6. Water heaters should have enough heat absorbing surface to get the heat into the water and have the gas combustion products cool where they leave the heater.

(Next Article: How To Burn Oil.)

Deaths

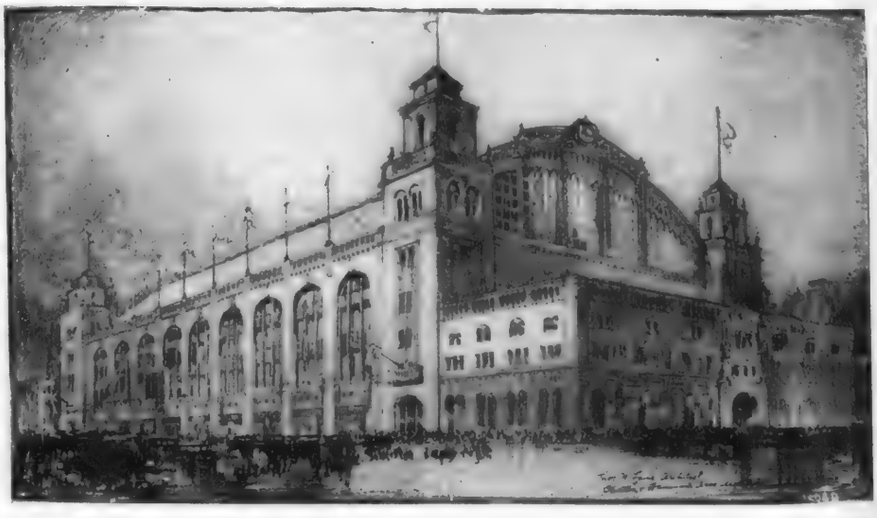
EDGAR C. MOLBY, whose death, as reported in lasts month's issue, occurred at his home in Forest Hills, L. I., January 29, was long prominently identified with the heating boiler industry. In his earlier years he was New York manager for the old Pierce, Butler & Pierce Mfg. Company. Later he developed the Molby boiler, incorporating a number of features of design which were regarded at the time as daring departures from conventional practice. These features were later combined with those of the Surrell heating boiler, and the heater became known as the Molby magazine-feed boiler. The company was taken over four years ago by the Iron Products Corporation, of which the Central Radiator Company and the Central Foundry Company are subsidiaries.

Mr. Molby was a member of the American Society of Heating and Ventilating Engineers, and had long been a regular attendant at the annual conventions of the Heating and Piping Contractors National Association. He was 54 years old. A widow and daughter survive him.

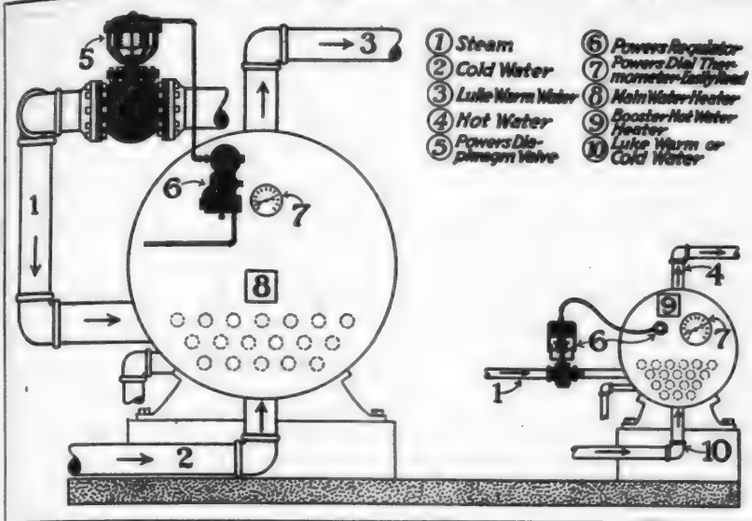
WILLIAM D. HOXIE, vice-chairman of the Babcock and Wilcox Co., New York, died January 3, on the steamship Southern Cross on its way to Rio de Janeiro. Body was returned on the Western World leaving January 21. Mr. Hoxie, who was a graduate of Stevens Institute of Technology and was a trustee of that institute when he died. From the time of his graduation until his death he was connected with the Babcox and Wilcox Company.

CHARLES LANGEFELT CHENOWETH, works business manager for Crane Co., Chicago, who died recently, was for 37 years associated with the company. Mr. Chenoweth was born in Chicago in 1860 and at the age of 27 began his career in the cost department of Crane Company. At thirty he was made manager of the brass manufacturing department, which position he held for almost a third of a century, being appointed works business manager in 1922.

Plans are Going Forward for Holding a National Heating and Ventilating Exposition in this Building at the Time of the Next Annual Meeting of the American Society of Heating and Ventilating Engineers in New York, January 25-30, 1926



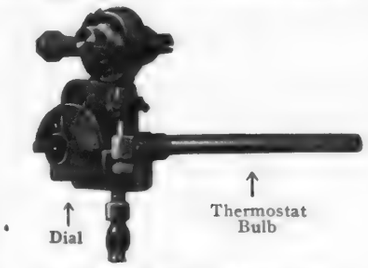
The New Madison Square Garden Building At 49-50th Street and Eighth Avenue, New York, Now Under Construction



This Diagram

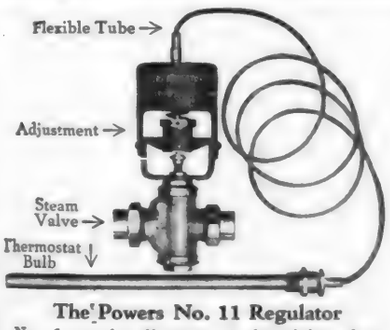
Typical installations of POWERS control on hot water storage tanks are here shown. At the left a No. 10 Regulator is used and on the right a No. 11. Further details of these regulators are given in the panels at the left, below.

POWERS regulators are each designed for a specific purpose, to meet specific conditions. No one regulator can fit all requirements. That is why we have developed so many types and designs.



The Powers No. 10 Regulator

No. 6 on the diagram at the left, above, indicates installation of this regulator. It is operated by air or water pressure. (Note the piping). A rugged, dependable regulator.



The Powers No. 11 Regulator

No. 6 on the diagram at the right, above, indicates typical installation for this regulator. It is self operating, without outside power. An accurate, simple, reliable regulator.

Powers Control on Water Heaters is Real Economy

In applying temperature control to ALL types of water heaters no other firm can offer you the breadth of experience or the wide variety of apparatus which we have perfected.

In studying the problems of your clients you no doubt find many places where accurate temperature control would save hundreds, perhaps thousands, of dollars a year. Every dollar spent for *hand* control of temperature is money gone forever, same as rent. Experience shows that money invested in Powers control pays handsome dividends.

Valuable Engineering Service

When you are confronted with any problems of temperature control let our engineers worry about it for you. They may be able to save you a great deal of time and needless trouble.

3021A

THE POWERS REGULATOR COMPANY

34 years of specialization in temperature control

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

1-Inch Pipe Coil, Concealed, Front and Top and Full Front Registers

1" PIPE COIL - CONCEALED RATING - STEAM 215° F.
FRONT AND TOP AND FULL FRONT REGISTERS
FRONT AND TOP REGISTERS
FULL FRONT REGISTER
FULL FRONT REGISTER 60% OPEN
ACTUAL SURFACE is the area of pipe surface per foot length of the coil selected
EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 250 btu. per sq. ft.

PIPES HIGH	PIPES WIDE	INCHES HIGH	INCHES WIDE	FRONT AND TOP REGISTERS 2 4" Actual Surface	2 4" Equivalent Surface	3 6½" Actual Surface	3 6½" Equivalent Surface	4 9" Actual Surface	4 9" Equivalent Surface	5 11½" Actual Surface	5 11½" Equivalent Surface	FULL FRONT REGISTER 2 4" Actual Surface	2 4" Equivalent Surface	3 6½" Actual Surface	3 6½" Equivalent Surface	4 9" Actual Surface	4 9" Equivalent Surface	5 11½" Actual Surface	5 11½" Equivalent Surface
7	1	15¼"	8"	4.9	4.90	7.3	6.60	9.7	8.05	12.1	9.52	4.9	4.76	7.3	6.51	9.7	8.05	12.1	9.38
8	1	18⅛"	8"	5.5	5.62	8.3	7.52	11.1	9.22	13.8	10.79	5.5	5.47	8.3	7.41	11.1	9.22	13.8	10.64
9	1	20½"	8"	6.2	6.30	9.4	8.55	12.5	10.43	15.6	12.19	6.2	6.42	9.4	8.44	12.5	10.43	15.6	12.02
10	1	22⅞"	8"	6.9	7.10	10.4	9.55	13.8	11.60	17.3	13.65	6.9	6.92	10.4	9.42	13.8	11.63	17.3	13.47
11	1	25¼"	8"	7.6	7.92	11.4	10.51	15.2	12.87	19.1	15.25	7.6	7.72	11.4	10.37	15.2	12.87	19.1	15.05
12	1	27⅝"	8"	8.3	8.48	12.5	11.44	16.6	14.08	20.8	16.75	8.3	8.48	12.5	11.44	16.6	14.08	20.8	16.54
13	1	30"	8"	9.0	9.04	13.5	12.16	18.0	15.04	22.5	18.00	9.0	9.04	13.5	12.16	18.0	15.04	22.5	18.00
14	1	32⅜"	8"	9.7	9.60	14.5	12.88	19.4	16.00	24.2	19.04	9.7	9.60	14.5	12.88	19.4	16.00	24.2	19.04
15	1	34¾"	8"	10.4	10.16	15.6	13.68	20.8	16.96	26.0	20.08	10.4	10.16	15.6	13.68	20.8	16.96	26.0	20.08
16	1	37⅛"	8"	11.1	10.72	16.6	14.40	22.2	17.92	27.6	21.12	11.1	10.72	16.6	14.40	22.2	17.92	27.6	21.12
17	1	39½"	8"	11.7	11.20	17.6	15.04	23.4	18.72	29.4	22.16	11.7	11.20	17.6	15.04	23.4	18.72	29.4	22.16
18	1	41⅞"	8"	12.5	11.68	18.6	15.68	25.0	19.60	31.2	23.20	12.5	11.68	18.6	15.68	25.0	19.60	31.2	23.20
19	1	44¼"	8"	13.2	12.16	19.7	16.13	26.2	20.40	32.9	24.16	13.2	12.16	19.7	16.3	26.2	20.40	32.9	24.16

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Radiator Ratings—I-in. Pipe Coil, Concealed, Front and Top and Full Front Registers — No. 14-FF

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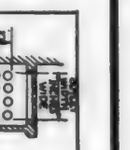
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

1¼-Inch Pipe Coil, Concealed, Front and Top and Full Front Registers



1¼" PIPE COIL - CONCEALED RATING - STEAM 215°F.

FRONT AND TOP AND FULL FRONT REGISTERS

ACTUAL SURFACE is the area of pipe surface per foot length of the coil selected
EQUIVALENT SURFACE is the equivalent number of standard Sq. Ft. of radiation at 250 bt.u. per sq. ft.

FRONT AND TOP REGISTERS — FULL FRONT REGISTER

PIPES HIGH	PIPES WIDE	INCHES HIGH	INCHES WIDE	2		3		4		2		3		4	
				4½"		7½"		10½"		4½"		7½"		10½"	
				Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
6	16½"			5.2	5.11	7.8	6.81	10.4	8.28	5.2	4.97	7.8	6.72	10.4	8.09
7	19½"			6.1	5.99	9.1	7.88	12.2	9.59	6.1	5.83	9.1	7.77	12.2	9.45
8	22½"			6.9	6.84	10.4	9.00	13.9	10.44	6.9	6.66	10.4	8.88	13.9	10.80
9	25½"			7.8	7.72	11.7	10.38	15.6	11.53	7.8	7.52	11.7	10.26	15.6	12.13
10	28½"			8.7	8.64	13.0	11.40	17.4	12.78	8.7	8.42	13.0	11.15	17.4	13.52
11	31½"			9.6	9.36	14.3	12.40	19.1	13.96	9.6	9.36	14.3	12.40	19.1	14.97
12	34½"			10.4	9.92	15.6	13.28	20.8	16.40	10.4	9.92	15.6	13.28	20.8	16.40
13	37½"			11.3	10.64	16.9	14.16	22.6	17.60	11.3	10.64	16.9	14.16	22.6	17.60
14	40½"			12.2	11.28	18.2	14.96	24.3	18.64	12.2	11.28	18.2	14.96	24.3	18.64
15	43½"			13.0	11.84	19.5	15.84	26.0	19.52	13.0	11.84	19.5	15.84	26.0	19.52
16	46½"			13.9	12.56	20.8	16.72	27.8	20.56	13.9	12.56	20.8	16.72	27.8	20.56

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Radiator Ratings—I¼-in. Pipe Coil, Concealed, Front and Top and Full Front Registers — No. 14-GG

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

1½-Inch Pipe Coil, Concealed, Front and Top and Full Front Registers

INCHES WIDE
INCHES HIGH
1½" PIPE COIL - CONCEALED RATING - STEAM 215°F
FRONT AND TOP AND FULL FRONT REGISTERS
FRONT AND TOP REGISTERS
ACTUAL SURFACE is the area of pipe surface per foot length of coil selected
EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 250 b.t.u. per sq. ft.
FULL FRONT REGISTER 60% OPEN

PIPES HIGH	PIPES WIDE — INCHES WIDE — INCHES HIGH	2 — 5½"		3 — 9"		4 — 12½"		2 — 5½"		3 — 9"		4 — 12½"	
		Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
		FRONT AND TOP REGISTERS						FULL FRONT REGISTER					
5	16"	4.9	4.68	7.4	6.16	9.9	7.37	4.9	4.55	7.4	5.98	9.9	7.15
6	19½"	5.9	5.55	8.9	7.34	11.9	8.76	5.9	5.40	8.9	7.14	11.9	8.51
7	23"	6.9	6.46	10.4	8.51	13.8	10.15	6.9	6.29	10.4	8.28	13.8	9.87
8	26½"	7.9	7.41	11.9	9.73	15.8	11.61	7.9	7.22	11.9	9.47	15.8	11.29
9	30"	8.9	8.32	13.3	10.92	17.8	13.05	8.9	8.11	13.3	10.64	17.8	12.702
10	33½"	9.9	9.12	14.8	12.16	19.8	14.63	9.9	9.12	14.8	11.86	19.8	14.25
11	37"	10.9	9.84	16.3	13.12	21.8	16.12	10.9	9.84	16.3	13.12	21.8	15.71
12	40½"	11.8	10.48	17.8	14.08	23.7	17.52	11.8	10.48	17.8	14.08	23.7	17.30
13	44"	12.8	11.20	19.3	15.04	25.7	18.64	12.8	11.20	19.3	15.04	25.7	18.64

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

2-Inch Pipe Coil, Concealed, Front and Top and Full Front Registers

2" PIPE COIL - CONCEALED RATING
STEAM 215°F
FRONT AND TOP AND FULL FRONT REGISTERS
ACTUAL SURFACE is the area of pipe surface per foot length of coil selected
EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 250 btu. per sq. ft.
FRONT AND TOP REGISTERS
FULL FRONT REGISTER 60% OPEN
INCHES WIDE
INCHES HIGH

PIPES HIGH ↓	PIPES WIDE INCHES WIDE INCHES HIGH	FRONT AND TOP REGISTERS						FULL FRONT REGISTER					
		2		3		4		2		3		4	
		7"		11½"		16"		7"		11½"		16"	
		Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
4	16"	5.0	4.76	7.5	5.63	10.0	6.83	5.0	4.69	7.5	5.71	10.0	6.83
5	20½"	6.2	5.40	9.3	6.90	12.4	8.38	6.2	5.33	9.3	7.00	12.4	8.38
6	25"	7.5	6.45	11.2	8.24	14.9	9.94	7.5	6.36	11.2	8.35	14.9	9.94
7	29½"	8.7	7.47	13.1	9.64	17.4	11.57	8.7	7.37	13.1	9.77	17.4	11.57
8	34	10.0	8.53	14.9	10.88	19.9	13.21	10.0	8.42	14.9	11.02	19.9	13.21
9	38½"	11.2	9.52	16.8	12.24	22.4	14.78	11.2	9.52	16.8	12.40	22.4	14.78
10	43'	12.4	10.40	18.7	13.67	24.9	16.48	12.4	10.40	18.7	13.84	24.9	16.48
11	47½"	13.7	11.20	20.5	14.88	27.4	18.25	13.7	11.20	20.5	14.88	27.4	18.25
12	52"	14.9	11.92	22.4	16.00	29.9	19.84	14.9	11.92	22.4	16.00	29.9	19.84

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Radiator Ratings—2-in. Pipe Coil, Concealed, Front and Top and Full Front Registers — No. 14-II

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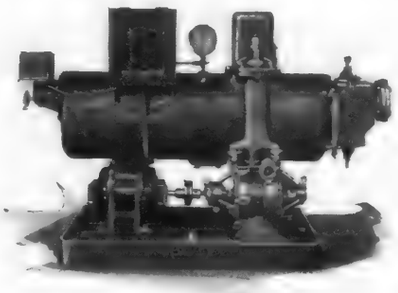
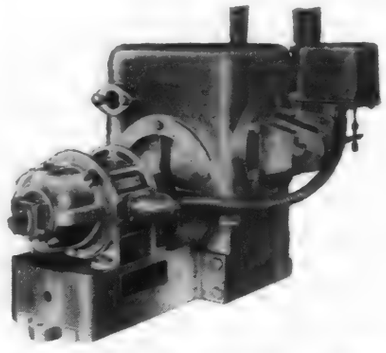
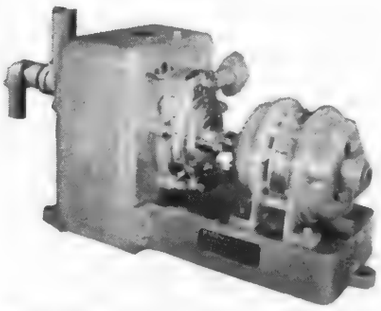
Heating economy assured *by* Jennings Hytors



Motor-Driven Jennings Hytor Vacuum Pump, for return line heating systems, in capacities up to 300,000 sq. ft. equivalent direct radiation.



Motor-Driven Jennings Hytor Condensation Pump, Unit Type, for removing condensate from steam heating systems, in capacities up to 16,000 sq. ft. equivalent direct radiation.



Motor-Driven Jennings Hytor Vacuum Pump, Size M, for return line heating systems, in capacities up to 5,000 sq. ft. equivalent direct radiation.

When you recommend the use of a Jennings Hytor Heating Pump, you can be sure of quick heat in the morning, even at the most distant radiator, in zero weather. The Jennings Hytor eliminates radiator noises and effects a material saving in fuel consumed for heating.

These facts have again and again been verified, not only by tests conducted by authorities of undisputed reputation, but by the many years experience of thousands of Hytor users.

Jennings Pumps are quiet in operation, occupy a minimum of floor space, have ample capacity for the conditions for which they are recommended, and save about 50% of the power consumed by other equipment of equivalent capacity. All parts such as air rotor, water impeller, rotor and impeller housings, port plates, sealing rings, clamping nuts and shafts are made of bronze. Receivers are heavy cast iron. Operation can be either continuous or automatic.

Complete information, literature and recommendations promptly furnished on request.

NASH ENGINEERING COMPANY

So. Norwalk Connecticut

Branch Sales Offices in Atlanta, Boston, Buffalo, Chicago, Cleveland, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle and Washington, D. C. In Canada—Montreal, Toronto and Vancouver.

Jennings Hytor

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Coming Events

April 1–3, 1925.—Second annual convention of American Association of Oil Burner Manufacturers, at Chicago, Ill. Headquarters at the Edgewater Hotel.

May 19–22, 1925.—Sixteenth annual convention of the National District Heating Association at West Baden, Ind. Headquarters at West Baden Hotel.

June 1–4, 1925.—Thirty-sixth annual convention of the Heating and Piping Contractors National Association at Detroit, Mich. Headquarters at the new Book-Cadillac Hotel.

Miscellaneous Notes

N. Loring Danforth, past-president of the Heating and Piping Contractors National Association, has been elected president of the Buffalo (N. Y.) Chamber of Commerce.

National Safety Council will make its Mid-West Safety Conference an annual affair on account of the success of the first conference, held in Chicago, January 19. Over 400 engineers and plant executives were in attendance, and many papers were presented and discussed.

Engineering Institute of Canada held its thirty-ninth annual meeting at Montreal, January 27, at which President Arthur Surveyor presided. The meeting continued through three days, receiving reports of committees, and of branches, electing officers, discussing the several papers presented and concluding with a dance and supper. Nearly 150 members attended, from all parts of the Dominion.

Plumbers, in Pennsylvania, are not required to be licensed by the State Board for Registration of Professional Engineers and Land Surveyors, according to an opinion recently handed down by the Attorney General of the State.

American Engineering Council has voted to continue participation in the activities of the National Board for Jurisdictional Awards, following the recommendations of a special committee headed by W. E. Bryan, St. Louis. The committee advises that, in five years of effective effort, the board has accomplished a valuable service to the contractor, architect, engineer and building owner, labor and the general public.

National Pipe and Supplies Association will hold its 1925 meeting at French Lick, Ind., May 26, 27 and 28.

American Association of Oil Burner Manufacturers will meet at Edgewater Beach Hotel, Chicago, April 1, 2 and 3. The association will welcome to the convention all manufacturers, dealers or prospective dealers, regardless of membership in the association.

"Own Your Own Home" Exposition, to be held in Philadelphia May 9-16, will not slight the heating and ventilating interests, as a special committee has been appointed, headed by R. C. Bolsinger, of the Fowler & Wolf Mfg. Co., to cover this field. It is expected that a large and well-balanced array of exhibits, many in action, will be secured.

Credit Crooks, through whose operations it has been estimated that over $250,000,000 losses are suffered by American business firms, will be fought to a finish by the National Association of Credit Men, with an initial funds of $1,000,000, now being raised. William H. Pouch, president of the Concrete

CANDY CONCERNS USE AUTOVENT

Candy factories must, of necessity, use considerable ventilating equipment to carry away heat, steam and foul air. In addition, they use blowers for handling shelled nuts, grated coconut and other materials, besides employing fans and blowers for cooling confections and maintaining circularization in dipping rooms.

Autovent Fans and Uniblade Blowers are installed in the leading candy factories.

During the past few months a number of important installations have been made. Write for complete data for your candy and industrial jobs.

ACTIVE SALES OFFICES AND AGENCIES IN ALL PRINCIPAL CITIES

AUTOVENT FAN & BLOWER CO.
DEPT. "H"
730-738 W. MONROE ST. . CHICAGO

Steel Company, New York, is national chairman of the committee.

Construction Activity for January was very satisfactory, according to the monthly report of F. W. Dodge Corporation, the aggregate contracts in the 36 eastern states being $296,000,000. This was substantially the same volume as was reported for January, 1923, which was the highest on record. New York State and northern New Jersey led the list (excepting the northwest States) with a gain of 10% over December, and 5% over last January. The northwest States showed high percentage gains,—35% over December, and 18% over January last, but the aggregate was only a trifle over $5,000,000, against over $110,000,000 reported from New York State and northern New Jersey. The distribution of the January contracts was as follows: residential buildings, 43%; commercial buildings, 23%; public works and utilities, 12%; industrial buildings, 6% and educational buildings, 5%.

Eastern Supply Association's winter meeting, held February 11 at the Hotel Astor, New York, was opened by an address of welcome by President George E. Keenen. Joseph F. Evans read a report on the work of the National Trade Extension Bureau; R. D. Kaufman, vice-president and manager of the loan department of S. W. Straus & Co., investment bankers, New York, addressed the association on "The Financial Outlook in the Building Industry;" and John G. Vogelpohl spoke on "The Activities of the Standardization Committee of the National Association of Master Plumbers."

"Saving Fuel Bills by Correct Firing" was recently broadcast from station WHA, at the University of Wisconsin, by Professor W. E. Wines, who is in charge of the vocational course in steam engineering, heating and ventilating of the Correspondence Study Department.

National Warm-Air Heating and Ventilating Association will hold its annual convention April 15-16, at the Hotel Hollenden, Cleveland, Ohio.

An "Association of Associations" may come into being as the result of a conference of executives of national and other associations, which was held at the Hotel Traymore, Atlantic City, February 27-28. The program included discussion of problems relating to increasing membership; those relating to conventions and expositions; to publicity, and to technique of management.

Department of Architecture, State of New York, at Albany, issues a multigraph list of projects in hand in the department. The list includes proposed buildings, building equipment, replacement and repairs, and should be of value to contractors, heating engineers, etc.

Meeting of the Association of Scientific Apparatus Makers of the United States of America, in Rochester, N. Y. November 14, last, as reported in the December issue, was inadvertently referred to in the story as a meeting of the sales force of the Taylor Instrument Company.

American Radiator Company's spring sales campaign on Arcola heaters was given wide publicity through a weekly radio broadcast, from station WGR, Buffalo, consisting of musical programs by the American Radiator quartet, followed by announcement of the standing of the various company branches. Reports indicate much interest from the general public, as well as from the salesmen directly interested.

Pittsburgh, it is reported, will have a new city official, a building inspector, who will enforce an entirely new heating, plumbing and electrical code. Conditions as they have existed in Pittsburgh, where building inspection has been under the jurisdiction of the city sealer, have brought about so many complaints that Mayor Montee has called a meeting of the building crafts to discuss the matter. It is probable that, with the new plan in operation, there will be a material reduction in Pittsburgh's insurance rates.

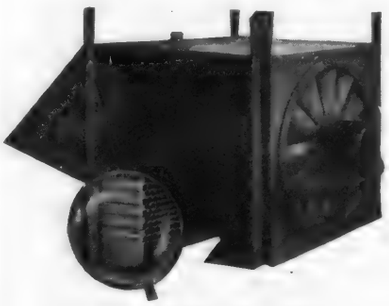
Oil Burner Association, Pittsburgh, Pa., comprising manufacturers and dealers of oil burners, gathered at the William Penn Hotel, Pittsburgh, Pa., January 6, to form an association for the purpose of advancing the oil burner business in Pittsburgh and vicinity. A second meeting was held in January at which time invitations were sent out to every oil burner dealer and manufacturer in the Pittsburgh territory.

WHY LET THAT UNHEATED BUILDING WORRY YOU

We manufacture Unit Heaters and Fan Heating Systems for every need. If steam is not available, our all steel direct fired Fan Furnace will meet your requirments.

Send us your heating problems and we will show you the easiest and cheapest way.

Recommendations and prices furnished cheerfully without cost to you.



COMET UNIT HEATER

Suitable for use where steam and hot water is available. This Heating Ace is especially adapted where compactness and lightness in weight is of importance. For complete description write for Bulletin No. 85.

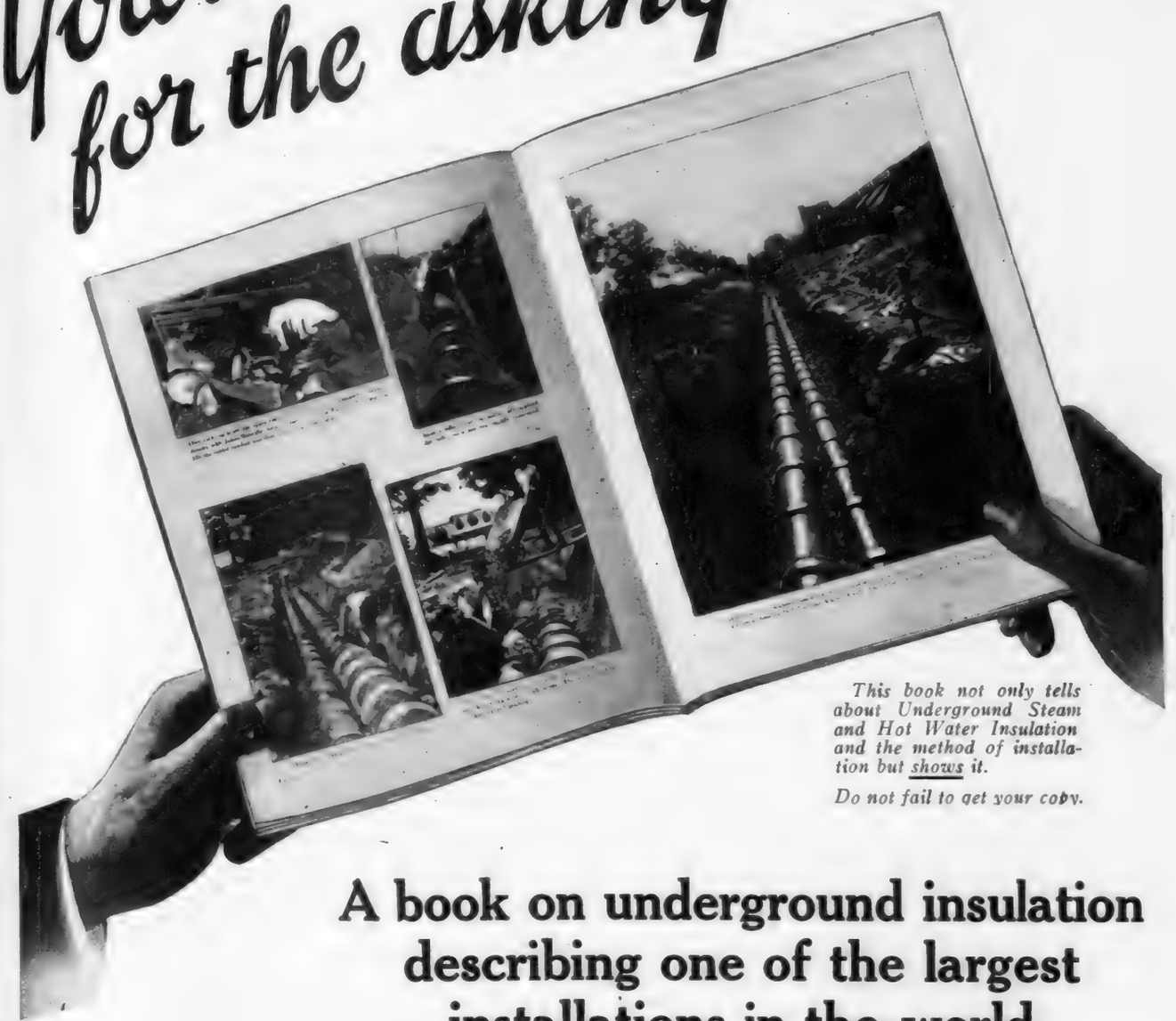
DIRECT FIRED FAN FURNACE

For use where steam or hot water is not available. For complete data write for Bulletin No. 90.

THE NEW YORK BLOWER COMPANY

CHICAGO, ILL. *Branch Offices in Principal Cities* LA PORTE, IND.

Yours for the asking



This book not only tells about Underground Steam and Hot Water Insulation and the method of installation but shows it.

Do not fail to get your copy.

A book on underground insulation describing one of the largest installations in the world

EVERY heating engineer should have this book containing complete data on the 19,400 ft. installation of the Johns-Manville Underground Insulation System on the steam and hot water lines of Cornell University.

It includes descriptions, tests, drawings and plans, progress and detail photographs, and other interesting pictures and text. It should be yours for reference. Send for your copy now.

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Branches in 62 Large Cities For Canada: CANADIAN JOHNS-MANVILLE Ltd., Toronto

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Underground System of Insulation

Associated Advertising Clubs of the World will hold their twenty-first annual convention in Houston, Texas, May 10-14, 1925. Approximately 5,000 delegates from all parts of the world will attend the convention. Members of 330 advertising clubs of the association will be present.

National Industrial Conference Board, New York, reports that the average retail coal prices for stove anthracite, chestnut anthracite, and bituminous coal for the country as a whole increased approximately 2% each, between July and November, 1924. The retail bituminous prices during this period varied considerably in different cities, ranging 25% increase in Jacksonville to 8.8% decrease in Detroit. Stove and chestnut anthracite prices varied much less than bituminous coal prices, the largest increase being 8.4% for stove size in Kansas City, Kan., and the greatest decrease 2% for chestnut size in Cincinnati.

Manufacturers' Notes

American Radiator Co., New York, announces the following appointments: C. K. Foster, vice-president and treasurer, in charge of western executive offices, to be executive vice-president; Wetmore Hodges, secretary, to be vice-president and secretary, director of advertising; R. B. Flershem, general manager of sales, to be vice-president general manager of manufacture, to be vice-president in charge of manufacture; A. E. Swanson, assistant to the president, to be vice-president and assistant to the president; Andre Mertzanoff, to be vice-president, planning and research.

American District Steam Co., North Tonawanda, N. Y., has appointed Stanley Sales Company, New York, as its representatives in New York, with offices at 5 Great Jones Street.

Everhot Heater Co., Detroit, Mich., will be represented in New York and vicinity by the Everhot Heater Sales Corp., 101 Park Ave. Carroll C. Fox, formerly field manager of the company, will be in charge, assisted by Harold W. Cheel, a graduate of Sheffield Scientific School, at Yale.

Centrifugal Fan Co., Boston, Mass., has purchased, at Receiver's sale, the assets of the Centrifugal Fan Co. of Newark, N. J., and will continue the business at 108 Milk Street, Boston.

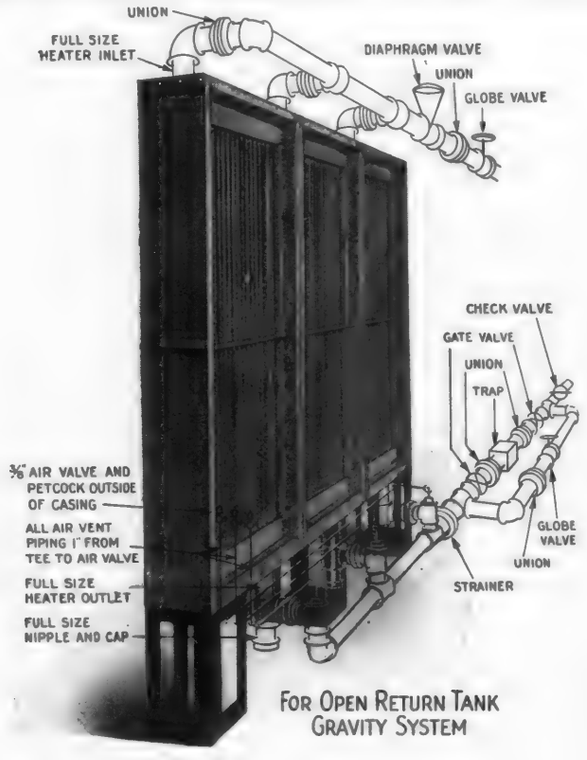
A. M. Byers Co., Pittsburgh, Pa., has sold a new issue of $5,000,000 first mortgage 6% bonds, $4,500,000 in participating preferred stock, together with 150,000 shares of common stock, no par value. The company has absorbed the Orient Coal & Coke Co., a $2,000,000 concern, which acquisition will solve the fuel problem of the Byers Company. A group life insurance program, involving a coverage of about $3,000,000 life protection for some 2,200 employees has been adopted by Byers.

American Blower Co., Detroit, Mich., announces an exclusive affiliation with Drying Systems, Inc., Chicago, Ill., for executing the company's air conditioning contract work. Drying Systems, Inc., has been engaged in work of this class for several years and the company's forces will now be augmented by several experts from the American Blower Company who are specialists in various lines of air conditioning engineering. All contracts will be taken in the name of and will be executed by Drying Systems, Inc., and will include the exclusive use of Sirocco apparatus manufactured by the American Blower Company.

Scott Valve Manufacturing Co., Detroit, Mich., has appointed R. F. Kleinman, Land Title Building, Philadelphia, Pa., as its sales representative. Mr. Kleinman will handle the complete line of Scott bronze and iron-body valves in eastern Pennsylvania, southern New Jersey, Maryland, Delaware and the District of Columbia. C. H. Tinker Co., 201 Devonshire St., Boston, Mass., has been appointed New England representatives.

Newport Boiler Co., Chicago, Ill., has moved its plant to Charles City, Iowa. Increased shipping facilities was the reason for the change. The new plant is fitted with the most modern equipment.

Lyon Products Co., Chicago, Ill., reports that the Lyon interlocking heaters installed in the Chicago Y. M. C. A. several years ago are responsible



FOR OPEN RETURN TANK GRAVITY SYSTEM

AEROFIN CORPORATION
750 Frelinghuysen Avenue
Newark, N.J.
L. C. Soule, *Sec'y and Chief Engineer*

AEROFIN

Fan-System Heating Surface

TO ENGINEERS AND ARCHITECTS:

Aerofin Saves Space and Weight.

The light weight and non-corrosive features of Aerofin, together with its unit construction, space saving and because it comes to the job already encased and ready for steam connections, demonstrates its superiority, and for this reason we believe Aerofin merits being incorporated in your specifications. SINCE THERE IS NO EQUAL TO AEROFIN, WHY NOT SPECIFY IT OUTRIGHT? At least, we ask you to specify Aerofin as a standard and to figure out the exact sizes and number of units required so that the contractor will know what to figure on.

TO THE CONTRACTOR:

SAVE TEN CENTS PER FOOT OF HEATING SURFACE by erecting the (completely encased) Aerofin Units in the same number of HOURS as you would need DAYS to erect the heavy heaters.

SAVE MORE MONEY with Aerofin on account of the smaller number of steam and return connections required.

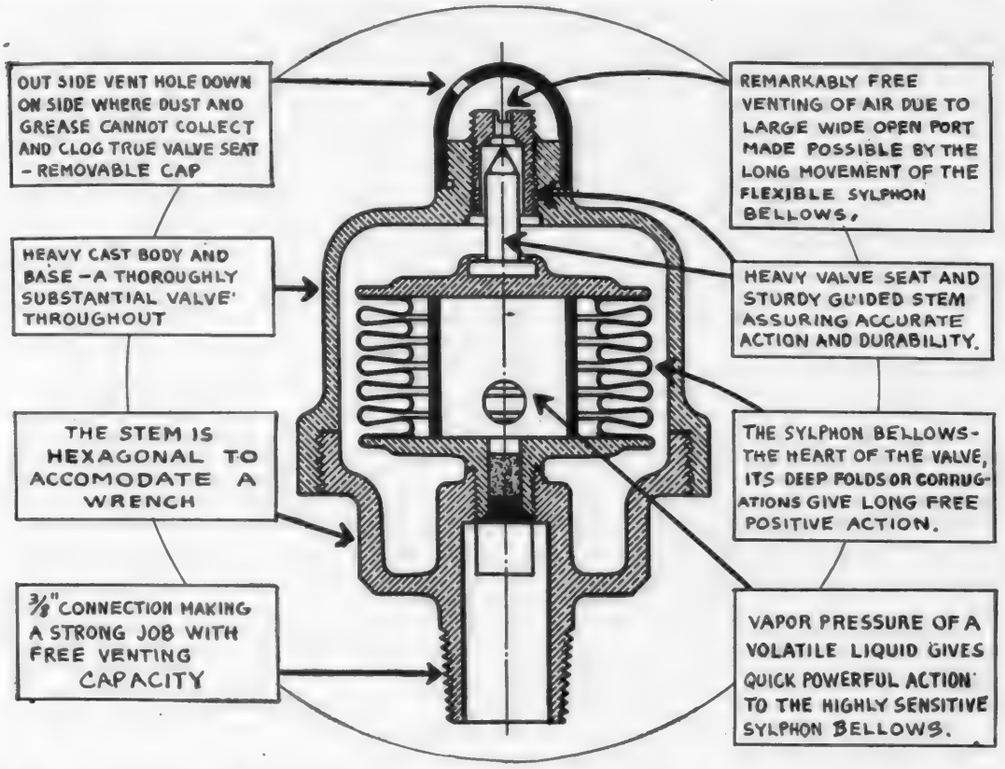
DON'T FORGET the saving in freight and cartage.

No extra reinforcement of the building construction required with Aerofin—may be suspended from ceiling with small angles and rods, without expensive platforms—may be handled with only ordinary care and assembled without using any block and tackle or scaffolding.

These features demonstrate that you can really save money by installing Aerofin altho the first cost, f. o. b. factory, may be a trifle higher than that of other fan-system heaters.

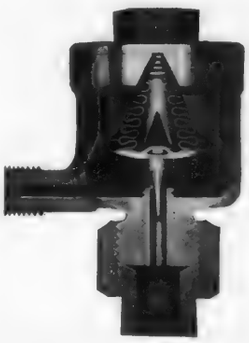
Illustration shows the ease with which several units high or wide of Aerofin may be assembled together by simply bolting thru the template punched flanges.

Aerofin Is Sold ONLY by Manufacturers of Nationally Advertised Blower Heating Apparatus.


OUT SIDE VENT HOLE DOWN ON SIDE WHERE DUST AND GREASE CANNOT COLLECT AND CLOG TRUE VALVE SEAT - REMOVABLE CAP
HEAVY CAST BODY AND BASE - A THOROUGHLY SUBSTANTIAL VALVE THROUGHOUT
THE STEM IS HEXAGONAL TO ACCOMODATE A WRENCH
3/8" CONNECTION MAKING A STRONG JOB WITH FREE VENTING CAPACITY
REMARKABLY FREE VENTING OF AIR DUE TO LARGE WIDE OPEN PORT MADE POSSIBLE BY THE LONG MOVEMENT OF THE FLEXIBLE SYLPHON BELLOWS.
HEAVY VALVE SEAT AND STURDY GUIDED STEM ASSURING ACCURATE ACTION AND DURABILITY.
THE SYLPHON BELLOWS - THE HEART OF THE VALVE, ITS DEEP FOLDS OR CORRUGATIONS GIVE LONG FREE POSITIVE ACTION.
VAPOR PRESSURE OF A VOLATILE LIQUID GIVES QUICK POWERFUL ACTION TO THE HIGHLY SENSITIVE SYLPHON BELLOWS.

A Sure Cure For Sick Steam Systems

THIS little quick Vent Valve (No. 527) installed at one or two points on the mains of an ordinary steam heating system will cure air bound conditions and produce hot radiators with surprising quickness.



No. 410. Sylphon Air Line Valve

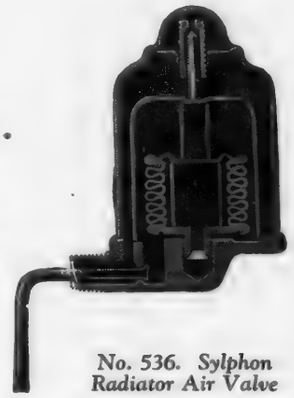
Vents air from radiators on air line systems. Sylphon bellows guarantees the closing of the outlet port, preventing escape of steam into the air line. Has ¼" male thread on inlet side and ¼" female thread on the outlet. Price $4.50

Has Everlastingly Strong Thermostat

Drawn from a flat sheet of metal *without soldered seams,* the Sylphon bellows used as the thermostatic element in all Sylphon Radiator Air and Vent Valves is sensitive, powerful, and practically everlasting. Breakdown, so common with the ordinary type of thermostat, is eliminated, for neither years of constant use nor the powerful action of steam weaken this marvelous bellows. The Sylphon bellows is filled with a thermosensitive liquid which vaporizes when steam comes in contact with it, expanding the bellows and closing the valve.

Price of this No. 527 Sylphon Quick Vent Valve is $3.00.

Ask for Bulletin WAV



No. 536. Sylphon Radiator Air Valve

Large Sylphon bellows guarantees positive closing against steam. Large orifice assures free venting of air. Large buoyant float prevents escape of water. Radiator connection ⅜", iron pipe size 1¾" in diameter by 3" high. Price $2.00

Sylphon

Radiator and Quick Vent Air Valves

THE FULTON COMPANY KNOXVILLE, TENN.

Originators and Patentees of the Sylphon Bellows

Sales offices in NEW YORK, CHICAGO, DETROIT, BOSTON, PHILADELPHIA *and all the principal cities in U. S.*

European representatives: Crosby Valve & Engineering Co., Ltd., 41–42 Foley Street, London, W. I., England

Canadian representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

for the selection of these heaters for the new Y. M. C. A. building in Austin, Ill., and Englewood, Ill., the cost of the two buildings being well over $1,000,000.

C. A. Dunham Company's annual sales conference, held in Chicago January 13, was attended by thirty branch office managers from United States and Canada. The factory at Marshalltown was visited on the 14th, for inspection, and for study of the working of the research department. The convention closed with a banquet, at which the 1924 sales contest prizes were awarded by President Dunham, who stated that the year had been the biggest in the 22 years' history of the company.

the American Society of Heating and Ventilating Engineers, John E. Griggs, of the factory, and Peter McMichael, of Canada were the Kewanee speakers, and the guests who spoke were: Warren E. Fuller, C. B. & Q. Railroad Company, George Mason, Scully Steel Service Co., and Witt K. Cochrane, of Chicago.

Crane Co., Chicago, announces the election of the following officers: President, R. T. Crane, Jr.; first vice-president, J. B. Berryman; vice-president in charge of manufacturing, C. A. G. Wayman; vice-president in charge of sales, E. H. Raymond; vice-president in charge of real property, W. J. Clark; vice-president and treasurer, P. T. Kelly; secretary, H. P. Bishop;

which are already completed, will be supplied from a central heating plant, at an estimated initial cost of about $75,000. An interesting feature of the system is the overhead distribution, the pipes being carried through the yards and gardens on piling. There will be about 12 miles of piping in the installation, which is being put in by Brightside Foundry & Engineering Co., Ltd., Sheffield.

New Incorporations

Federal Radiation & Boiler Co., Chicago, capital $250,000, to manufacture boilers, radiators and castings. Incorporators; C. V. Kellogg, F. W. Fix and J. D. McGuire.

Branch Office Managers of the C. A. Dunham Company

Kewanee Boiler Company, Kewanee, Ill., at its annual meeting added $400,000 to capital stock, making it $3,600,000. This will permit selling the added stock to employees, instead of half of that amount as previously proposed. All of the 6% bonds of the company now outstanding, due March 1, 1929, 1930, 1931 and 1932 have been called, and will be retired March 1. The following officers were re-elected: President, E. E. Baker; vice-president and treasurer, B. F. Baker; secretary, H. D. Cherry; assistant secretary, E. F. Wagner; general manager, M. F. Moore; sales manager, R. B. Dickson, and assistant treasurer, Arthur Cook. The company's annual dinner, January 22, brought together, at Kewanee, executives, office force and representatives from all over the country. President E. E. Baker presided, and, as "shop talk" was taboo, the speakers made it a man-to-man affair that was thoroughly enjoyed by the largest gathering yet recorded.

Homer Addams, former president of

assistant vice-president in charge of sales, C. R. Crane II; assistant vice-president in charge of manufacturing, A. F. Gartz, Jr.

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., announces the initiation of a new Engineering Research Department under the direction of Victor Wichm, chief engineer. This department will concentrate on a study of the requirements for automatic control, and allied problems, in various industries.

Station Central Heating Notes. 12 pt. Bodoni bold.

Purdue University, Lafayette, Ind., has asked the State legislature for $20,000 for the construction of a modern central heating plant.

Virginia, Minn. municipal central heating system will be asked to extend service to a new section of city, known as Zone 5.

Conisboro, England.—That England is not asleep in the application of central heating to groups of residences, is shown in the report that about 800 new miners' homes at Conisboro', half of

Fee & Mason Mfg. Co., Inc., New York, capital $150,000, to continue the heating and plumbing supply business of Fee & Mason.

Monash-Younker Co., 553 West Monroe St., Chicago, capital $50,000, to manufacture heating specialties. Incorporators; Charles P. and Louis P. Monash.

H. A. Thrush & Co., Peru, Ind., capital $10,000, to manufacture heating and plumbing specialties.

E. C. Peacock, Inc., Brooklyn, N. Y., capital $20,000, to conduct a heating business. Incorporators; H. V. Kuntze, E. C. Peacock and Samuel Klasky.

C. L. Dougherty & Co., Wilmington, Del., capital $100,000, to conduct a heating and plumbing business.

New Firms. 12 pt. Bodoni bold c&lc.

West Hudson Supply Co., 359 West 42nd St., New York, has taken over the business of the Hudson Boiler Co.

Caddo Plumbing & Engineering Co., Shreveport, La., has taken over the business of Caddo Plumbing Co., capital increased to $25,000.

Who fumbled the ball?

Scene 1:—President's office before game was called in plant

President: "He may be the best halfback Tech ever had, but this shows what college amounts to."

Consulting Engineer: "Did he have the correct data as to your requirements?"

President: "Measured everything himself, when he was home last summer, and his mother begged me to let him show what was in him. It's cost me a clean $5,000. If it wasn't for the big game Saturday I'd wire him now to come home, get in the factory and learn something practical."

Consulting Engineer: "What does the contractor say about it?"

President: "You and Murphy can fight it out."
(Turning to 'phone) "Send in Mr. Murphy, the contractor. We're ready for him."

Mr. Murphy (entering): "I got your letter, and my answer is that any changes will have to be charged at regular rates. The whole trouble is in the small sizes of pipes that your son specified."

Consulting Engineer (studying the blueprints): "Just a minute. This is all right. Can't help but deliver 80 lbs. pressure if the boy knew what to specify. Look to me like faulty installation. Where can I get a copy of the specifications on this job?"

President: "I kept a copy myself. Here they are."

Consulting Engineer: "Will you come over to the new extension with me, Mr. Murphy? And, I think (turning to the President) if you want to save money in the future you might tag along too."

* * * * *

Scene 2—Game called in the plant

AS THE three men entered the extension the President got the surprise of his life. His halfback son in overalls was standing on a step-ladder wielding a wrench; a section of the piping near the door had been dismantled.

Son: "Hello, dad, this is a crime; no wonder mother wired me. Did you write that telegram?"

President: "What telegram?"

Son: "About mother passing the ball to me. That I fumbled it? What I'd like to know is who fumbled my specifications. Look at these scrap-iron hangers, and this archaic pipe cutting."

Consulting Engineer: "Just what I thought. The specifications call for reamed pipe."

President: "What do you mean, 'reamed'?"

Consulting Engineer: "The burrs on the inside of this pipe. Feel them. This pipe has been cut by hand and never reamed. Those burrs caused accumulations of sediment and nearly stopped up some of the lines."

Son: And the specifications call for hangers fully adjustable so that the pipe lines can be properly aligned after installation. (Turning to Murphy) With hooks like these how do you propose to take care of the usual sagging of pipe lines in a new building? Hangers like these only breed fat repair bills for some one to pay."

Murphy: "Hangers, adjustable after the pipe is up? I never heard of anything like that."

Son: "Every contractor and dealer in piping has a catalog of Grinnell adjustable hangers. The recommendation accompanying my specification was to buy from Grinnell Company all the welded headers, hangers and fittings and have them cut the pipe to sketch with fittings made on. The job would have gone through like the Tech team cleaning up the scrubs. That company always reams every foot of pipe it cuts. What became of my recommendation?"

President (sheepishly): "Blame me, my boy. I held out that last page when I told the purchasing department to get estimates."

Consulting Engineer: "Same old mistake in a new garb. You've always killed my recommendations if they limited competition and it has cost you many thousands. This time you were determined not to be such a fatherly fool as to let your own son cut out all price competition on the work. You admit it cost you $5,000 in money and more than that in worry."

President: "Hereafter I guess I'll stay in the grandstand and root for the Skill team against the Bungle team from Priceville."

Have you received the Hanger Blue Book?

A new edition of the Grinnell Hanger Booklet has been issued—an edition even more complete, more comprehensive, and more valuable than the gray booklet which thousands of engineers are using to save time and figuring on specification work. This new edition is called the Grinnell Hanger Blue Book. Send for your copy or copies today.

IF it's an industrial piping specification of any kind, see Grinnell Company, Inc., about the materials, or suggest to your contractor the simplicity and satisfaction of placing all orders for piping supplies with one large and responsible firm. Address all inquiries to our home office at No. 280 W. Exchange Street, Providence, R. I.

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers, and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

Furnishing Materials from Engineering Specifications a Specialty

New York University's Course in Heating and Ventilating Engineering

In starting a practical evening course in heating and ventilating, New York University makes a strong appeal to those men who are to contemplate being engaged in the industry. F. C. Houghten, formerly of the Research Laboratory of the American Society of Heating and Ventilating Engineers, and at present secretary of the society, has charge of the course. The work consists of a series of fifteen lectures, from 8:00–10:00, on Tuesday evenings, at 32 Waverly Place, New York, supplemented by laboratory work on Saturday afternoons in the new engineering laboratory at University Heights.

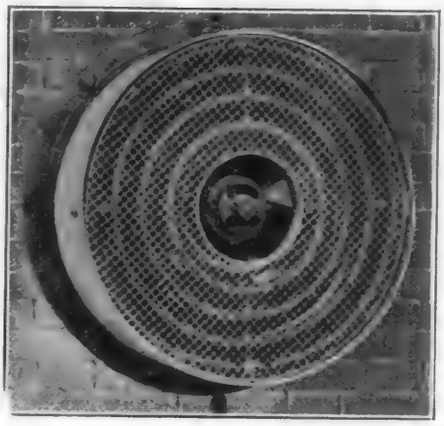
Among the topics for discussion are: water, steam and air heating; heat transmission of building materials; radiators for direct heating; stacks and fans for indirect heating; heating boilers and furnaces; direct and indirect systems of heating; ventilation; air conditioning; domestic, factory and district systems of heating; pipes, valves, coverings, ducts and other accessories.

For laboratory work there are equipment of fans, heating boilers and other apparatus for testing purposes. A tuition charge for the course is $15.00.

Because of the interest already shown in this work, it is probable that a two-year course, leading to a certificate in heating and ventilating will be started next September. Detailed information may be obtained from H. G. Tyler, director, Evening Division, New York University, 32 Waverly Place, New York.

A Unique Air Tempering Unit

Weldex air-tempering units are the product of the Victoria Tube Company, Ltd., and are marketed by A. Fleming Browne, 11 Cartaret Street, S. W. 1. London. These units, as the illustration indicates, are for use with electric or power exhaust fans, and, where high-pressure steam is available, may be used for the removal of steam in laundries, etc.



Weldex Air Tempering Unit

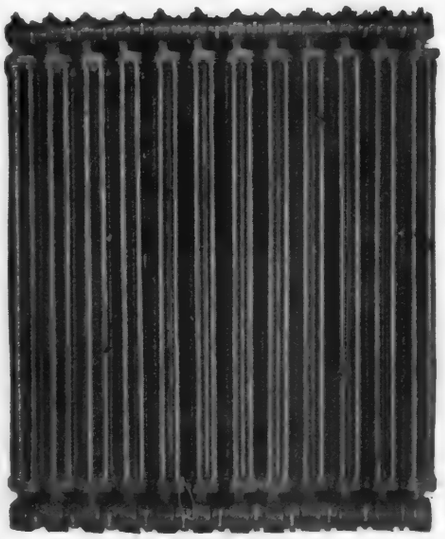
How the Lowly Tractor and Steam Roller Met Heating Emergencies

The boilers of tractors and steam rollers may not be highly economical for commercial heating purposes, yet they may be of inestimable value in emergencies. Witness a report from Logansport, Ind., that when the heating plant of the City National Bank went out of commission, a steam roller, parked in front, kept the funds in circulation. Also from Indiana (Hoopeston) comes the tale of a large steam tractor getting on the job and keeping up steam while a new boiler was being installed.

A New Warm-Air Furnace Humidifier

Humidity in homes is provided for through the use of a furnace and radiator humidifier manufactured by the Heating-Ventilating & Humidifier Co., 2217 South Millard Ave., Chicago, Ill. The humidifier consists of a special texture linen hose, capped at each end and surrounded by a protective metallic casing. This is inserted in the furnace, and is piped to the water

12 Points in favor of Lyon Interlocking Heaters for Hot Blast Heating



Front view of Heater made up of 5 rows of 12 sections each, 70" on 5" centers, and containing 1050 sq. ft. of heating surface with 13.2 sq. ft. Free Area. Weight 5820 lbs.

Some Territory Still Open to Reliable Agents

—Guaranteed against cracked or broken sections under steam pressure up to 100 lbs.

—Light in weight, avoiding expensive foundations or supports.

—Made to fit in space of any height from 40 inches to 140 inches in steps of 10 inches, thus avoiding piling up or decking.

—Made in small units that can be assembled in the building, and handled through any window, door or small opening.

—Closely assembled, thus giving greater heating surface in smaller space.

—All prime heating surface with the resulting high efficiency.

—Admit steam at the top, the force of which drives the air down to the air vents at the bottom, thus assuring rapid and uniform circulation.

—Have all advantages of old style pipe heaters (in satisfactory use for forty years), without bulk and weight.

—Made of full strength Spellerized pipe, virtually rust and corrosion proof.

—Headers and bases are pressed in by hydraulic pressure without threading—sections assembled with extra heavy right and left nipples.

—Designed for extreme conditions, such as 40° below zero intake temperature and velocity up to 2000 feet per minute, under which conditions of temperature, humidity and velocity, the condensation becomes excessive.

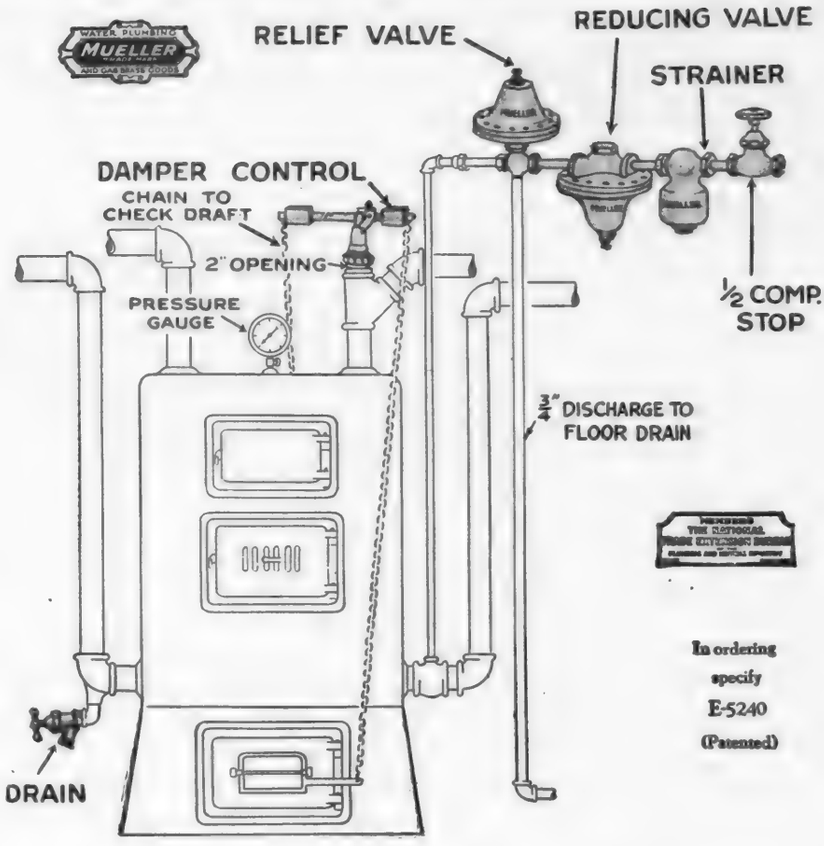
—Price compares favorably with that of other heaters, and their light weight saves on freight. Cost of installation also much less.

—These heaters have been adopted and are being used by a number of the largest MANUFACTURERS of UNIT HEATERS throughout the country, also by some of the large fan manufacturers.

Valuable Data FREE Our 68 page catalog containing over 70,000 result figures of data on final temperatures and condensations from certain intake temperature and velocity, which cost over $2,000 in cash and over 250,000 figures to compute, mailed free to Engineers, Architects and Contractors of record—write for it.

LYON PRODUCTS CO., Inc.

314-316 Union Park Court **Chicago, Ill.**



Automatic System of Hot Water Control

has no unsightly and expensive expansion tank—it operates directly on city water pressure—it is shipped assembled and can be installed in an hour's time—and then it works satisfactorily and efficiently.

Does its work automatically

After the Mueller System is installed and in operation, the owner pays no further attention to the valves—they work automatically—thousands of users testify that they do this faithfully.

The simplicity, dependability and reasonable cost of the Mueller System have created a big demand for it and made it an easy seller.

MUELLER CO., Decatur, Illinois

Established 1857

Factories—Decatur, Ill., Fort Huron, Mich., Sarnia, Ont.
Branches—New York — Los Angeles — San Francisco
Canadian Factory: Sarnia, Ontario

supply. The water, seeping through the hose, is absorbed by the surrounding air, and it is stated that from 2 to 4 cu. in. of water may be evaporated per minute.

Individual humidifiers may be attached to radiators, either vertically, adjacent to the section with air valve, or horizontally, behind or above the radiator.

Recent Trade Publications

ELECTRO-VAPOR RADIATORS having the appearance of the conventional cast-iron type, are featured in a circular issued by the Electro-Vaporic System, Royal Oak, Mich. Steam is supplied by an electric vaporizer attached to the radiator, the unit being portable, and, in the smaller sizes connected to any lamp socket. Several sizes are listed, the larger, up to 21 sq. ft. radiating surface, being automatically controlled by a thermostat.

WEINMAN, TYPE "HH" AUTOMATIC CENTRIFUGAL VACUUM AND BOILER FEED UNITS, is the title of Bulletin No. 200 issued by the Weinman Pump Mfg. Co., Columbus, Ohio. The folder states that this pump is designed with a view to simplicity in removing air and water from a steam heating system and returning this water to the boiler with minimum loss of heat. The unit consists of two independent centrifugal pumps. One pump exhausts the air and vapor from the heating system and the other feeds the boiler.

WESTINGHOUSE ELECTRIC HEATERS, have been found admirable for heating from an economical and non-devitalizing standpoint, says a letter issued by the American District Telegraph Company. This concern is using many of them in their offices throughout the country.

Typical Use of Westinghouse Electric Heaters in Offices

G-R INSTANTANEOUS HEATER, the purpose of which is to heat large quantities of water by live or exhaust steam, to supply the heat which has been lost in the heating system of large buildings or groups of buildings which are heated by forced hot water circulation; to save fuel, and to increase boiler and condenser capacity, is the subject of folder, Form 202, issued by the Griscom-Russell Co., New York.

INTER-OCEAN STACKULATOR, an automatic draft control, is the title of a folder issued by the Inter-Ocean Products Co., Chicago, Ill. The "Stackulator" is designed to build up steam, to hold the steam, regulate combustion, constantly change the air in the boiler room, reduce the volume of smoke, and reduce coal consumption. It is not a damper or breech installation, adds the circular, is simple in operation and can be installed wihout drawing fires.

NIAGARA ELECTRIC STEAM RADIATORS, an individual heating system which can be placed anywhere where there is

AT IOWA CITY—

RECITATION BUILDING, IOWA CITY, IA.
PROUDFOOT, BIRD & RAWSON, Architects
DES MOINES

Your buildings, Ozone Ventilated, will operate with corresponding economy. And with the design of our Type E equipment, the original cost is no longer prohibitive. Full data is now available. Write for it.

Ozone Ventilation—

plays its part in keeping the expenses down.

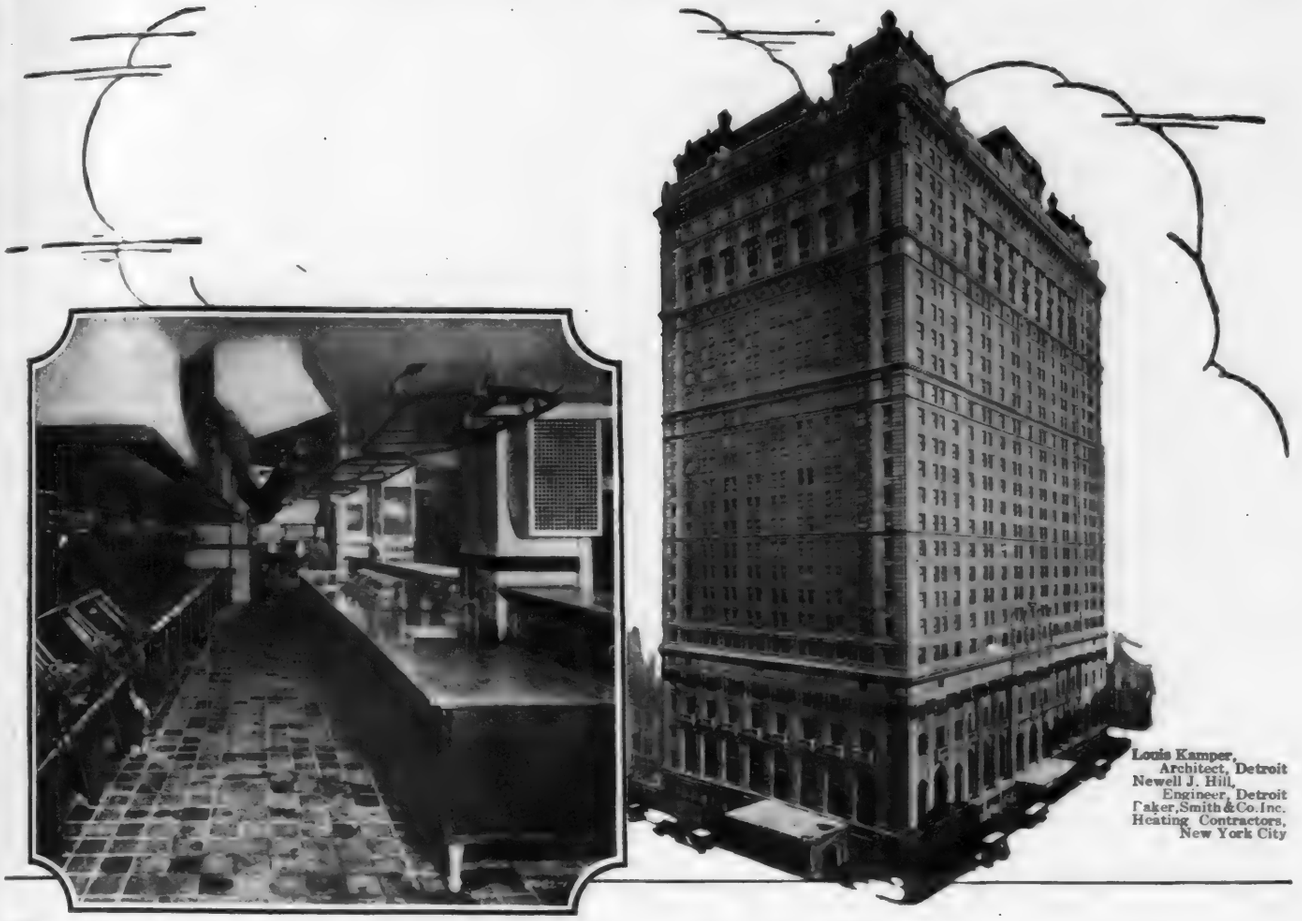
The Type E-24 Ozone Generator in the Recitation Building at the Iowa State University at Iowa City, Iowa, by deodorizing and purifying the return air, allows a recirculation of 85% of the total air volume handled.

The saving in fuel each month in this building alone more than covers the original cost of the equipment.

OZONE PURE AIRIFIER COMPANY

1455 W. Congress Street, Chicago

Ozone Ventilation is Economical Ventilation



Louis Kamper, Architect, Detroit
Newell J. Hill, Engineer, Detroit
Faker, Smith & Co. Inc. Heating Contractors, New York City

The Magnificent, New Book-Cadillac is American Blower Equipped

Twenty-eight American Blower Sirocco Fans are moving 757,000 cubic feet of air per minute, to keep the new Book-Cadillac, the world's tallest hotel, properly ventilated.

American Blower products are adequately solving the most difficult ventilating problems in the country today. They are silently doing their work in every type of structure from the world's tallest hotel to the depths of mine, from the small office to the largest manufacturing plant.

American Blower Ventilating Systems are easy to install. They are shipped complete in every detail and clearly marked to facilitate quick installation.

Competent engineers, located in our branch offices in all the principal cities, are always ready to aid in solving all problems in ventilation. They work in co-operation with you, bringing to bear upon your own peculiar problems the accumulated and varied experience of over forty successful years in the manufacture of air handling equipment.

Write for free bulletins and complete information

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

American Blower

"Sirocco" TRADE MARK

VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

Manufacturers of all Types of Air-Handling Equipment — Since 1881

available a proper electrical outlet, is the title of a folder issued by the Buffalo Gas Radiator Corp., North Tonawanda, N. Y. This new electric heating system consists of a "Niagara" cast-iron radiator fitted with extra size nipples at the bottom into which the heating element is fitted. This element extends through the entire radiator. A three heat switch is made a part of and affixed to the radiator.

The elements used are of the heavy-duty type, made exclusively for "Niagara" radiators, and were tested thoroughly for a period of three years before being adopted for this work.

All "Niagara" Elements are of the universal type for use on 25 or 60 cycle current, 110 volts either direct or alternating. 220 volt elements of the single heat type can be supplied on special order.

UNIT HEATERS, as manufactured by Aerofin Company, were the subject of a talk by Lawrence C. Soule, secretary of the company, at the February meeting of the Illinois Chapter, held in Chicago, February 9. The March meeting was to be devoted to papers on oil burners by prominent men in that industry.

David J. Jones is chairman of the chapter's committee on Section 3 of the proposed Code of Minimum Requirements for Heating and Ventilating of Buildings, instead of Ernest F. Jones, as stated in the December issue.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

HEATING SALES ENGINEERS WANTED.—Leading manufacturer of vacuum and vapor specialties has several exclusive territories open in the east and central west. Commission basis. Only competent men with standing in this field will be considered. Address E. W. Aubinger, Milwaukee Valve Co., Milwaukee, Wis.

POSITION WANTED.—Construction engineer and superintendent thoroughly experienced in supervising, erecting and estimating heating and ventilating, power and industrial piping, desires permanent connection with future possibility of purchasing interest in live concern. Address H. A. Erickson, care H. B. Buxton, 180 West 238th Street, New York City.

HEATING AND VENTILATING ENGINEER AND ESTIMATOR WANTED by a large concern located in northern Ohio. Experience essential, good opportunity for one fully qualified to take charge of heating department. State references and salary desired. Address Box 31, care Heating and Ventilating Magazine.

ENGINEER, technical, with practical knowledge of hot water and domestic heating; to such a man with vision and executive ability and seeking possibilities a rare opportunity is offered with new company. Address Box 32, care Heating and Ventilating Magazine.

DRAFTSMAN WANTED.—Heating and ventilating draftsman with at least two years' college training. In reply state education, experience, age, when available, salary required and send sample of drawing. Smith, Hinchman & Grylls, architects and engineers, 800 Marquette Building, Detroit, Mich.

CANADIAN DISTRIBUTORS with warehouse facilities and Dominion wide connection in heating field seek additional lines. Address Box 124, care of Heating and Ventilating Magazine.

SALES ENGINEER WANTED.—Sales engineer acquainted with heating and ventilating trade to represent, in special territory, superior hot-blast heaters. Liberal arrangement to a capable, live wire. Address, with experience and qualifications, Heating, 710 Union Trust Building, Chicago, Ill.

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Your valuable inventions
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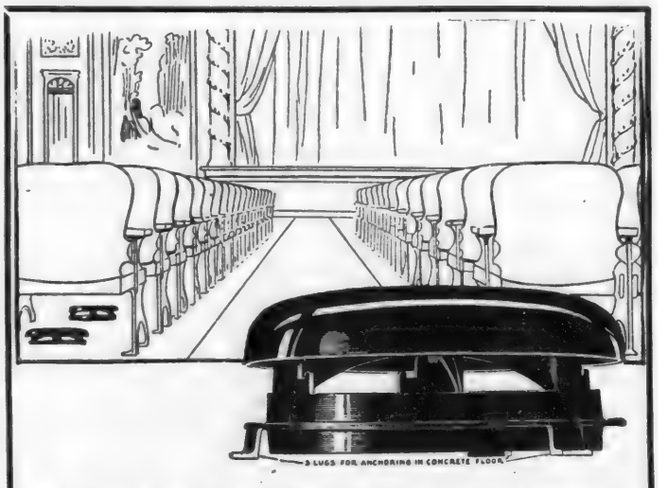
Register your trade marks.
Prompt attention. Superior Service
Lester L. Sargent, Patent and Trade Mark Atty.
524 10th Street, Washington, D. C.



"NOTCH" MUSHROOM AIR DIFFUSERS
FOR AUDITORIUMS

Have meant comfort to thousands of audiences.

Cool or warm fresh air evenly distributed.

Send for table of capacities and velocities

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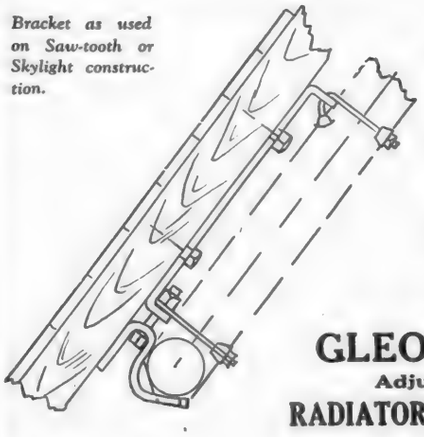
202 Franklin St. New York

Bracket as used on Saw-tooth or Skylight construction.



No. 2 for Horizontal Wall Radiators.

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Adjustable
RADIATOR BRACKETS

Patented

hang radiators in any position. They are easily erected, and being adjustable make the process of hanging radiators exceptionally easy.

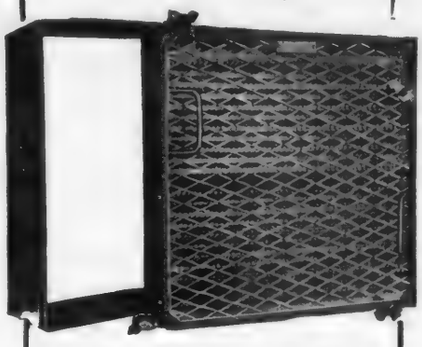
Used in buildings where the best equipment is specified, and are preferred because they are also strong, inexpensive, sanitary and invisible after erection.

And will fit any make of wall radiator.

Let us send you descriptive booklet and trade discounts.

A. F. GLEOCKLE, Jr.
415 Bay Street ROCHESTER, N. Y

Clean Air in School Ventilation



Cell and frame of the New Model Type U-2 Midwest Air Filter.

THE NEW MODEL TYPE U-2 MIDWEST AIR FILTER is a marked improvement over all previous makes and models of air filters, in efficiency, capacity, operating characteristics, ease of handling, and maintenance costs.

It is based on the baffle impingement principle, common to all Midwest Air Filters, but possesses many unique features which lead to greater economy in operation and insure the removal of all harmful dust and bacteria, without building up of excessive resistance and without clogging.

If you will make a careful study of this new model, giving close consideration to its basic principles, fundamental characteristics and sturdy construction, you will convince yourself of its superiority over all other air cleaning equipment on the market.

The vital importance of Clean Air in the ventilation of school buildings, whether located in cities or suburbs, is generally recognized by architects and engineers today. The rapidly growing list of schools in which

MIDWEST AIR FILTERS

are installed for this purpose, is ample evidence of this fact.

This list includes not only public and private schools, but colleges and universities as well. Large cities, such as New York, Chicago, Baltimore, Pittsburgh, etc., are of course represented. But smaller cities and suburbs are also included, such as Reading, Pa.; New London, Conn.; Superior, Wis.; Bronxville, N. Y.; Ely, Minn.; Claymont, Ill.; Ashtabula, Ohio, etc.

Midwest Air Filters have an unbroken record of successful service in supplying clean air for school buildings. If you have a school job on your boards at this time, let us show you what we have done, and what we can do.

Dept. F-4 is at your service for complete details and literature, or for arranging a call by a Midwest Representative.

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INCORPORATED
100 EAST 45TH STREET
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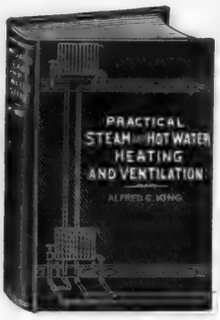
FIFTH EDITION ENTIRELY REVISED AND ENLARGED

Practical Steam, Hot Water Heating and Ventilation



By ALFRED G. KING

Author of "Questions and Answers on Steam, Hot Water and Vacuum Heating," etc.

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400 (6x9) Pages

Fully Illustrated by 400 Detail Illustrations

A New Book from Cover to Cover

A Practical Book Written by an Expert

This book is designed especially for all engaged in the practice of Steam, Vapor, Hot Water Heating and Ventilation. The author has spent over thirty-five years in the heating trade. He is a Registered Heating Engineer, the author of several steam heating books and has written many technical articles covering every phase of heating and ventilation.

This book tells how to secure heating contracts and how to install the most modern apparatus. Shop practice, "Tricks of the Trade," methods of estimating radiation, valuable rules and tables, and hundreds of helpful hints and other data are given for the use of heating contractors, engineers, architects and steam fitters.

CHAPTER VI.
The chimney flue—Sizes of chimneys—Height of chimneys—Table of heights and areas—Elements of a Good Flue—Common sources of chimney trouble.

CHAPTER XIII.
Estimating radiation—Heat losses—B.t.u. loss through building construction—B.t.u. loss through walls—B.t.u. loss through glass—Infiltration and Leakage—Rules for estimating radiation—For steam—For hot water—For vapor—Some dependable rules—The B.t.u. method of estimating radiation.

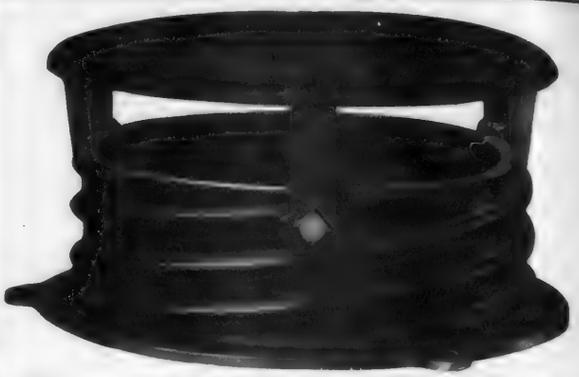
CHAPTER XV.
Exhaust steam heating—Value of exhaust steam—Fixtures used with exhaust heating systems.

CHAPTER XXX.
Temperature Regulation and Heat Control—High pressure damper regulators—Thermostatic temperature regulation—Early devices—The Howard thermostat—The Minneapolis heat regulator—The Honeywell thermostat and regulator—The Johnson system of temperature regulation—The Powers system—The National system—Bishop & Babcock system.

CHAPTER XXXIV.
Ventilation for school buildings—General requirements—Non-mechanical methods—Aspirating vent flues—Exhaust fans.

CHAPTER XXXV.
Mechanical ventilation and hot blast heating—Growth and improvement—Methods employed—Heat losses and heating capacity required—Quality of the air supply—An ideal system—A typical ventilating system—Fans for blowing and exhausting—Types of heaters—Methods of driving fans—Air duct constructions—Factory Heating—Testing systems of heating and ventilation.

THE HEATING and VENTILATING MAGAZINE
1123 BROADWAY, NEW YORK



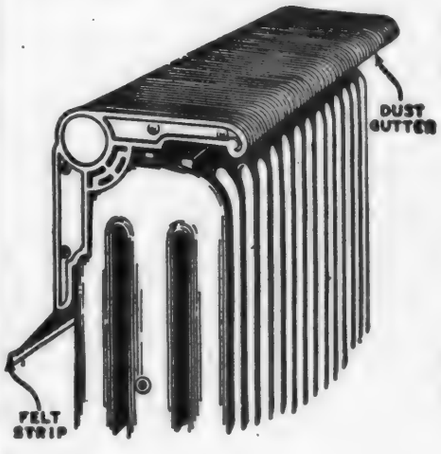
For VENTILATION Use Lyon Toad Stools

They are Vent Caps of great strength, unobstructed throat, rigid non-rattling construction. The adjustment is from full open to full closed. The height of the floor member prevents sweeping dust and refuse into them. ¶Their efficiency and economy make them particularly adaptable for theatres, auditoriums, etc.

Send for table of capacities and velocities

LYON PRODUCTS COMPANY
312-316 Union Park Court
Chicago - - Illinois

ACME RADIATOR SHIELDS



are a necessity in every home or building.

All Metal Design

Protection to walls and draperies is guaranteed

ACME shields are neat in appearance, strong and durable.

The price is right. Shipments are prompt.

Live aggressive agents are wanted.

Write for Particulars

ACME RADIATOR SHIELD COMPANY
320 Central Office Building Cincinnati, Ohio

After May - - Will the "Heating System" be Idle?

WHEN the first warm days arrive, do you close down your heating system for the summer? Does equipment which perhaps cost many thousands of dollars stand idle during those months when economies are most needed.

If you use a Buffalo heating system, with air-washer, you can obtain the maximum benefit from your investment all the year 'round.

In the winter no method is more economical or efficient for heating, while in hot weather you can distribute air thru your entire building, assuring plenty of cool fresh air, and making employees, customers or patrons, as the case may be, more comfortable.

And an important consideration is that "Buffalo" Ventilation usually costs less than direct radiation.

Engineers and contractors find it easy to explain the many particular advantages of using Buffalo fans and Carrier air washers. If you are not familiar with these, ask for our catalogs.

A Buffalo Central Fan Heating System at the National Acme Co., Cleveland.

Buffalo Forge Company

480 Broadway :: :: **Buffalo, N. Y.**

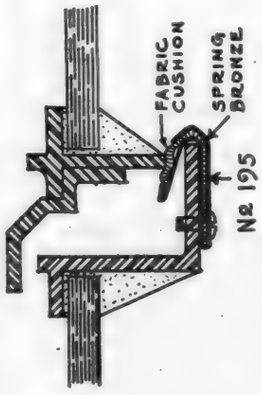
Athey

Cloth-Lined Metal Weatherstrip

Can be applied to Metal Sash

Athey Cloth-Lined Metal Weatherstrip (patented) is the ***only*** weatherstrip which can be successfully applied to metal sash of all kinds.

Notice the sectional drawing showing Athey equipment for Drawn Steel windows. Athey strip gives a ***cloth and spring bronze contact*** with the steel sash, through which air, dust and noise cannot sneak. The cloth and spring bronze are sufficiently resilient so that even when the sash is not "true" the contact is perfect.



A special 3-ply Windsor Cloth is used. It won't stretch, rot or pull out.

Recently the foremost manufacturer of steel sash wrote all their sales representatives as follows:

"Athey Weatherstrip is the best we have seen for this purpose and can readily be applied after the sash is erected and glazed. It can be used for pivoted, projected or casement windows."

Write for information and prices

Athey Company

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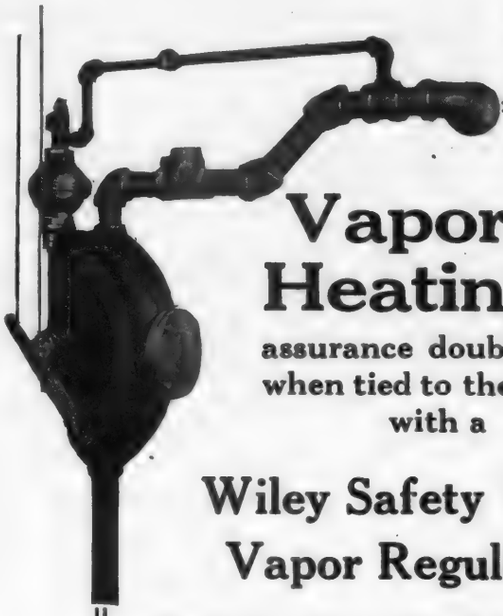

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assurance doubly sure when tied to the boiler with a

Wiley Safety Vent Vapor Regulator

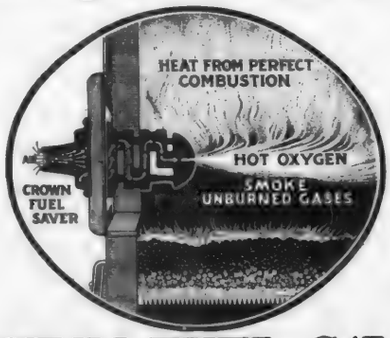
Write for your copy of booklet describing the Wiley line of vapor heating specialties.

peerless quality product manufactured and sold exclusively by

The Simplex Heating Specialty Co., Inc.

Lynchburg, Va.

A Scientific Method of Burning Coal and Coke



CROWN FUEL SAVER

and SMOKE *Consumer*

Fits the feed door of any heating plant. Saves 20% or more of coal. Practically eliminates all black smoke.

The CROWN Fuel Saver produces a given amount of heat from considerably less coal by burning the heat-laden gases that are ordinarily lost up the chimney. (See illustration).

Write for Full Details.

Heating engineers are invited to write for full details of this scientific coal-saver and heat-producer and for our special DEMONSTRATION OFFER.

CROWN FUEL SAVER CO., 70 N. 10th St., Richmond, Ind.

THE
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CHICAGO

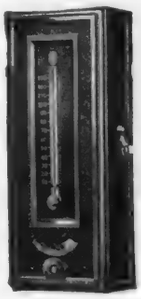
HOLABIRD
&
ROCHE
ARCHITECTS

Heating Contractor: PHILLIPS-GETSCHOW CO.
Plumbing Contractor: J. J. DALY

Higher First Cost of Powers Control Is Justified in the End

Systems of Automatic Temperature Control that need yearly adjustments and frequent repairs are not only annoying, but waste Fuel and cause much discomfort.

These troubles and the annual "SERVICE" bills, which so often come with lower *first-cost* systems of temperature control, will not be known by the owners of the new Palmer House. For in selecting Powers control for the Heating and Ventilating and Hot Water Service equipment of this splendid new building, the Architects have provided their clients with a system of control that will give many years of Accurate, DEPENDABLE service without repairs or adjustment.



THE POWERS
TYPE D THERMOSTAT

THE POWERS REGULATOR COMPANY

34 years of specialization in temperature control

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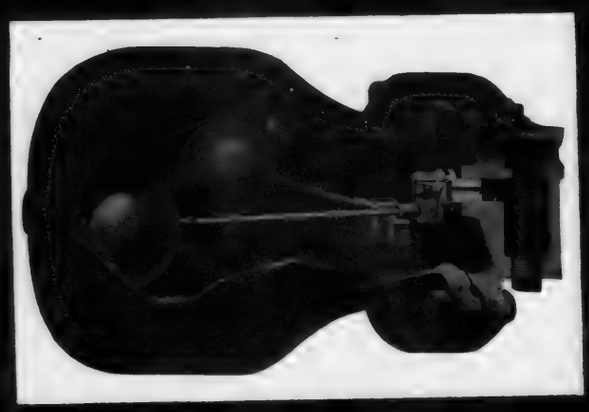
Is Thermal Control for Oil Fired Boilers?



McDONNELL & MILLER DUPLEX WATER FEEDER

For application to all low pressure steam heating boilers either coal-fired, oil-fired, or gas-fired. Write for Bulletin E-1

The automatic controls which are furnished with modern oil burners care for every condition except the most essential one—*the boiler water line.*

Low water with the burner in operation means cracked sections or burned boilers. High water or a flooded boiler means reduced boiler efficiency and wasted fuel.

The McDonnell & Miller Duplex Water Feeder absolutely protects the boiler by reliably maintaining the proper boiler water line and also enhances the convenience of oil fired boilers by entirely relieving the operator from worry over the amount of water in the boiler.

It is a very essential protection where heating boilers depend upon electrically driven pumps, because it insures proper water level even if electric current is interrupted or cut off.

Mc DONNELL & MILLER

CONWAY BLDG. CHICAGO

UNIVERSAL

The "Universal" Unit Ventilation System

THE CAVE MAN—
knocked a hole in the roof of his cave in order to get ventilation.

SOME PEOPLE—
still try to emulate him by opening windows.

BUT—
it does seem a little unreasonable, DOESN'T IT?

JOHN J. NESBITT, Inc.

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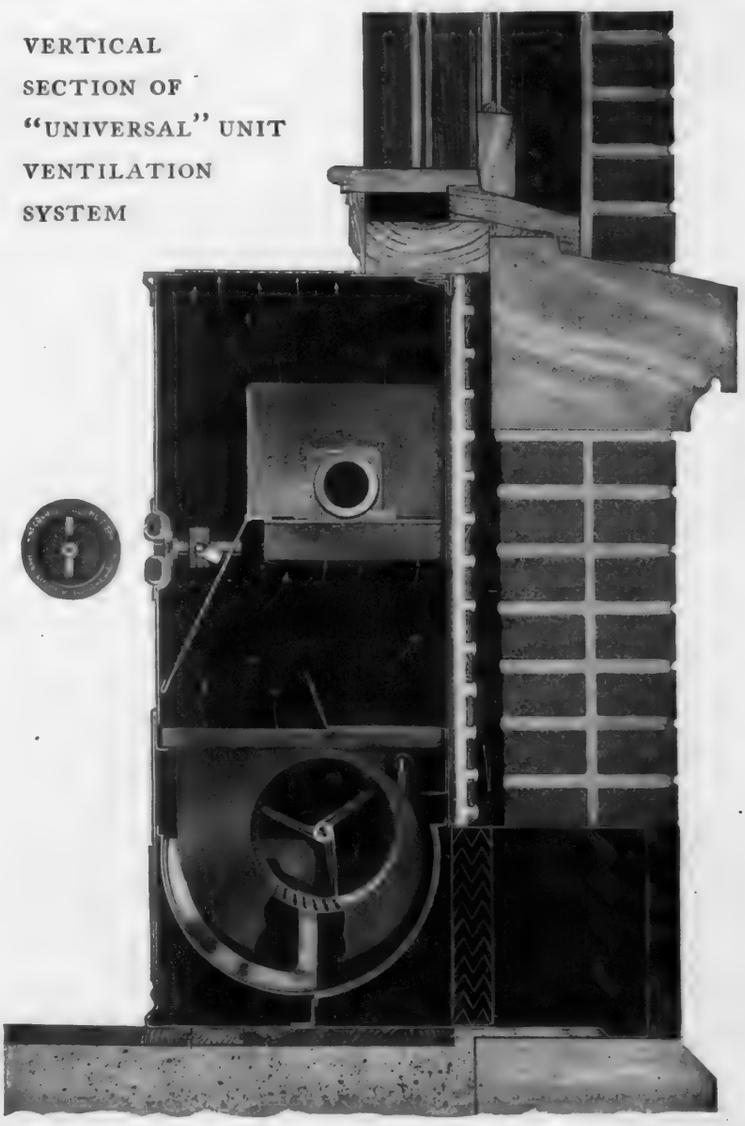
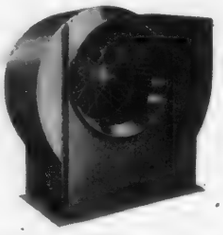
VERTICAL SECTION OF "UNIVERSAL" UNIT VENTILATION SYSTEM



UNIVERSAL

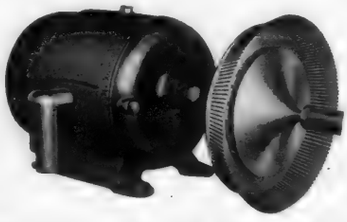
INSTALL ALL THREE

On your next "heating and ventilating" system, install the three Bayley units that assure a profitable job for yourself and a satisfactory installation to your client.



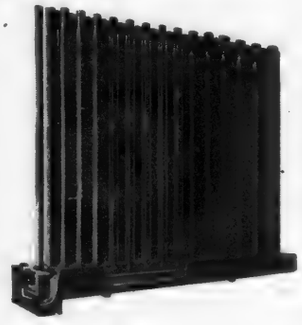
THE PLEXIFORM FAN

A sturdily built, light, easy running blast wheel that moves the greatest volume of air at low operating cost. Made in various sizes, either single or double mounts, engine, motor or lineshaft drive. Produces a maximum of air delivery, against low or medium high resistance, with a minimum power requirement.



THE TURBO AIR WASHER

keeps temperature and humidity uniform throughout the year, regardless of weather. The Turbo Atomizer, consisting of a single fire type nozzle and spray wheel, produces a dense curtain of water thru which no impurities can pass. Operates at nominal water pressure with a power saving of 40 to 60% as compared with a high pressure multiple spray system.



CHINOOK HEATERS

The most improved form of Indirect Heaters. Built on the "tube within a tube" principle, every tube a complete radiator in itself. Construction is such that there are no return bends, elbows and nipples. Permits use of steam at either low or high pressure. Its construction is such as to make every square foot of the Chinook prime heating surface.

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Send for any one or all three of the following bulletins describing this Bayley equipment in detail: No. 24 Chinook Heaters, No. 25 Turbo Air Washer, No. 26 Plexiform Fans.

BAYLEY MFG. CO.

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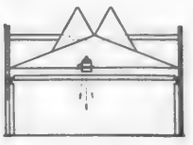
AIR ENGINEERING AND EQUIPMENT

Wing Featherweight Unit Heaters Installed above a Traveling Crane Thirty Feet from the Floor!

The many and varied installations of Wing Featherweight Unit Heaters in existence prove conclusively that the OVERHEAD INSTALLATION is correct in principle. By maintaining a vertical circulation from ceiling to floor, these units heat the floor level first, and prevent the accumulation of excessively hot air at the ceiling by continuously withdrawing it from that point and distributing it downward to the floor. In addition to saving floor space, they conserve fuel.



This cut shows a unit located above a traveling crane 30 feet from the floor. A perfectly heated building resulted from this installation.

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Fans and Blowers *Damper Regulators*
Unit Heaters *Small Turbines*

Hudson & 13th Sts. New York City

—and a profitable business too!

Besides rendering a good service to your customers, there is also a profitable business in handling **C. S. B. APPROVED SPRINKLER HEADS.**

They can now be bought from us direct either separately or with all the other necessary equipment for sprinkler systems. Use your own pipe and your own crew and get the business.

Also, after a fire, sprinkler heads have to be replaced. A stock should be kept on hand for demands of this nature.

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Reed Air Filters are easily installed in old or new systems. Let our engineers furnish you with complete data and sketches. No obligation.

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LORD AND TAYLOR'S, R. H. Macy and Co. and Russek's—three of the world's best known and best equipped department stores—are using Reed Air Filters. The fact that Reed Filters were decided upon by these New York stores after thorough investigation and careful comparisons is concrete evidence of their efficiency and economy. By removing 97% of dust, soot and bacteria from the air, Reed Air Filters insure health and comfort to individuals and the maximum of cleanliness to buildings and materials wherever used.

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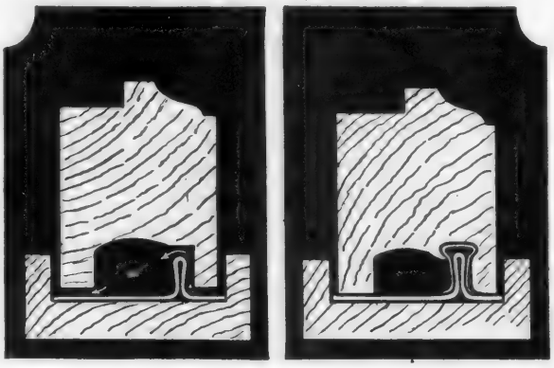
HIGGIN
ALL METAL
WEATHER STRIPS



Ordinary single-member strip Sash grooved for cord — *The exclusive Higgin Insert Strip completes the job*

Are you recommending the right weather strips?

The only weatherstrips made with a self-holding spring-flange **Insert** are Higgin All-Metal Weatherstrips.

No window without this **Insert** can be as draft-tight as a Higgin-equipped window. The illustration shows why.

The spring flanges of the **Insert** lightly grip the sides of the raised rib and close the space around the sash at every point. There is no air leakage where the sash is cut out for the cord, nor seepage around the rib when the sash shrinks. The metal-to-metal contact insures a perfect fit and closure; also an easy-sliding sash under all conditions.

A Higgin Installation means added comfort, greater fuel saving, increased satisfaction with the heating system.

HEATING ENGINEERS! You can safely guarantee a definite heating efficiency for your equipment when Higgin All-Metal Weatherstrips are installed. They keep all the cold air out and all the warm air in. They never lose their close fit by warping or shrinkage of frames. Every job is installed by trained Higgin men and guaranteed by the Higgin organization. Recommend Higgin All-Metal Weatherstrips to your customers.

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Manufacturers of Higgin All-Metal Weatherstrips and Higgin All-Metal Screens

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That Burns Soft Coal—Lignite
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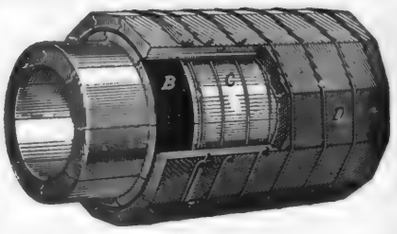
1123 Broadway, New York City

Wyckoff's Improved Cypress Covering



Lasts as Long as The Pipe Itself

As well as being highly efficient in its application, Wyckoff Improved Cypress Steam Pipe Covering withstands all conditions attending steam pipe trenches. All engineers who know Wyckoff Pipe covering specify it because it lasts.

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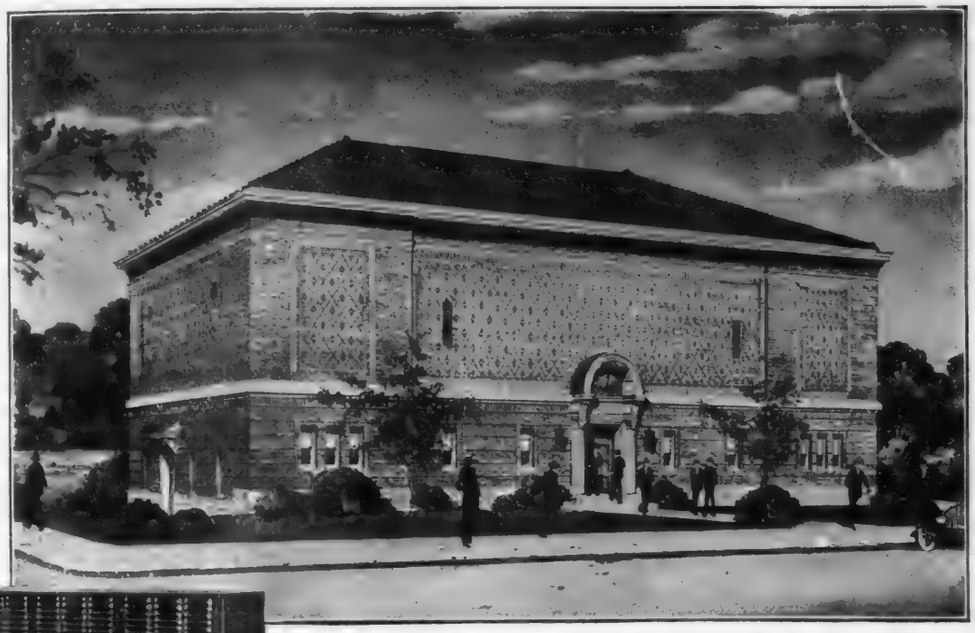

Masonic Temple at Dobbs Ferry, N. Y. Adolph H. Knappe, Architect, Ardsley, N. Y. Heating Contractors, Haines and McDonough, Hastings, N. Y.

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THE SILENT UNIT HEATING AND VENTILATING SYSTEM

For Schools, Churches, Club Rooms, Lodges, Offices, Banks, etc.

Made in designs for various condition and different buildings. Four sizes, with capacities respectively of 750, 1,000, 1,250 and 1,500 cubic feet of fresh air tempered to 70° per minute. Saves fuel, saves power, starts by pressing a button—stops the same way.

"Look us up in Sweet's"

Another Interesting HEATOVENT Installation—*Just Finished*

THIS is the new Masonic Building for Diamond Lodge, F. & A. M., No. 555, at Dobbs Ferry, N. Y. ¶ This beautiful building contains lodge room, club rooms, dining room, and janitor's quarters, with anteroom and all modern arrangements for comfort and utility. ¶ HEATOVENTS are installed to heat and ventilate the larger rooms, being concealed in specially designed recesses to avoid using space for heating apparatus. ¶ Architects and engineers requiring detailed information regarding HEATOVENTS may obtain it on application to our nearest branch office.

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Aluminum and *Glass* are *unaffected* by dry ozone or electronic bombardment.

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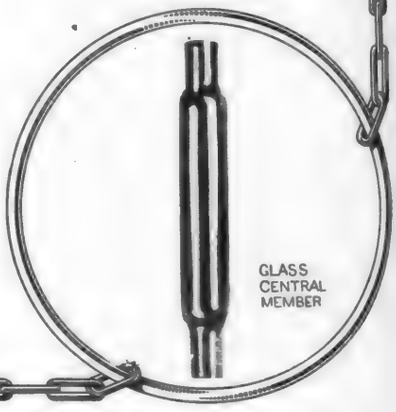

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5 Buckets of Dirt a Day!

and the Reason

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IN the First National Bank Building of Boston twelve million cubic feet of air per hour is supplied by Sturtevant Silentvane Fans and Air Washers.

By means of the latter, the air in this building is washed to make it pure. And every night attendants carry away five buckets of dirt, mud and other impurities, taken out of the air, that otherwise would have been discharged into the bank's offices and committee rooms.

Air is drawn in from the outside—thoroughly laundered by Sturtevant Air Washers and circulated thru-out the rooms and corridors of this building.

Engineers who select Sturtevant Air Washers obtain the highest type of air washing apparatus.

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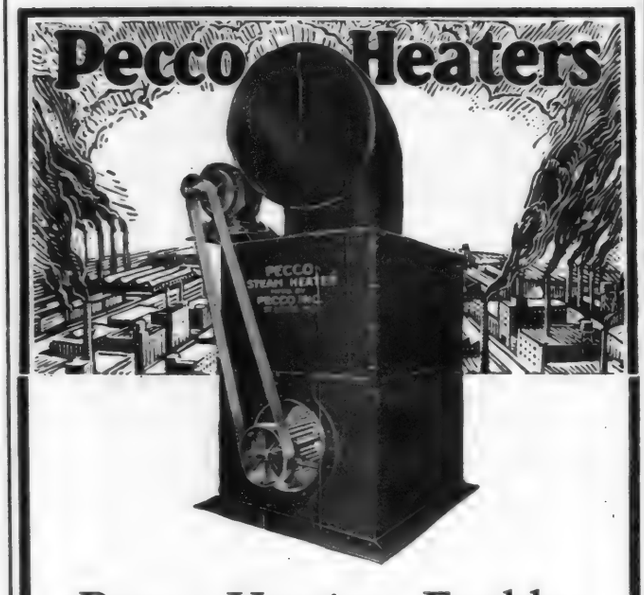

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The energetic, widespread heat distribution of a Pecco Unit multiplies the effectiveness of a given volume of heat, from three to six times. You can figure a corresponding reduction in generating costs as well as upkeep.

In plants where steam is available Pecco Steam Units utilize either live or exhaust steam. Without the installation of an intricate, ramified system of ducts for heat distribution they spread heat evenly throughout great spaces. And because they do not depend on the comparatively passive principle of radiation they make more economical use of the heat that steam generates.

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Where a product is to be dried, or ventilation is a problem, or gas fumes are to be expelled, as in garages or foundries, Pecco Units serve a double purpose.

The evidence of Pecco utility, economy, and adaptability in actual operation under diverse and trying industrial conditions, is shown in a bulletin we will gladly send you. Among the many hundreds of Pecco installations we can doubtless find for you a practical example of Pecco performance under circumstances similar to your own.

We will welcome your questions for specific information as to Pecco adaptability, and will reply fully, without obligation to you.

Our Bulletins also describe all details of Pecco mechanical superiority. State in your request whether you are interested in the Steam or Direct Fired Heaters.

The makers of Pecco Heaters also make Pecco Blow Pipe and Ventilating Systems. Ask us how they can serve in your plant.

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MECHANICAL EQUIPMENT OF FEDERAL BUILDINGS. By Nelson S. Thompson. Third revised edition, covering the basic data used by the Treasury Department in the design of the entire mechanical equipment of Federal Buildings under its control. Includes data on heating and ventilating, plumbing, drainage and water supply systems, gas piping, conduit, and wiring systems, lighting fixtures, elevators, small power plants, motors and controlling apparatus, vacuum cleaning systems, operating data, etc. Size 6 x 9 in. 400 pages. Cloth $4.00.

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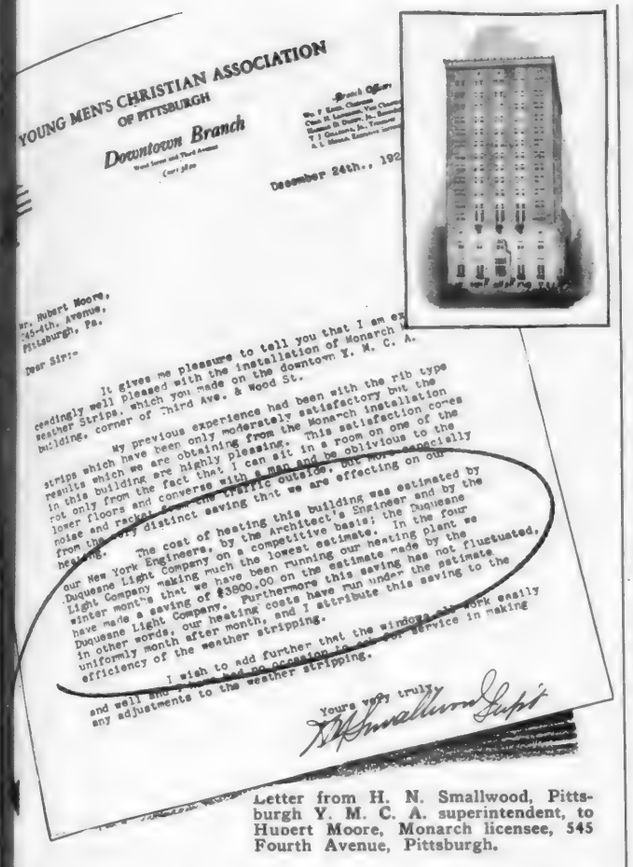


YOUNG MEN'S CHRISTIAN ASSOCIATION
OF PITTSBURGH
Downtown Branch

December 24th., 192

Mr. Robert Moore,
545-4th. Avenue,
Pittsburgh, Pa.

Dear Sir:-

It gives me pleasure to tell you that I am exceedingly well pleased with the installation of Monarch Weather Strips, which you made on the downtown Y. M. C. A. building, corner of Third Ave. & Wood St.

My previous experience had been with the rib type strips which we are obtaining only moderately satisfactory but the results which we are obtaining from the Monarch installation in this building are highly pleasing. This satisfaction comes not only from the fact that I can sit in a room on one of the lower floors and converse with a man and be oblivious to the noise and rackets from the traffic outside, but more especially from the very distinct saving that we are effecting on our heating.

The cost of heating this building was estimated by our New York Engineers, by the Architect's Engineer and by the Duquesne Light Company on a competitive basis; the Duquesne Light Company making much the lowest estimate. In the four winter months that we have been running our heating plant, we have made a saving of $3800.00 on the estimate made by the Duquesne Light Company. Furthermore this saving has not fluctuated, in other words, our heating costs have run under the estimate uniformly month after month, and I attribute this saving to the efficiency of the weather stripping.

I wish to add further that the windows and doors easily and well enough to necessitate any adjustments to the weather stripping.

Yours very truly,

Letter from H. N. Smallwood, Pittsburgh Y. M. C. A. superintendent, to Huoert Moore, Monarch licensee, 545 Fourth Avenue, Pittsburgh.

Monarch Strips Cut Heating Costs $3,800 *in four months!*

Note what Mr. Smallwood says in that marked paragraph!

"In the four months we have been running our heating plant, we have made a saving of $3,800 on the estimate by the Duquesne Light Company. Our heating costs have run under the estimate uniformly month after month, and I attribute this saving to the efficiency of the weather stripping."

Heat for this building is furnished by a steam-heat company, and charges based on meter measurements. The cost of Monarch Strips and their installation on 545 windows and doors totaled $2,797.50. The four-month saving on heating costs effected by these interlocking, adjustable strips not only paid the full cost of the strips and their installation, but left an additional profit of $1,002.50 for the building owners. And Monarch Strips will not only last as long as the building itself, but always work as well as when new!

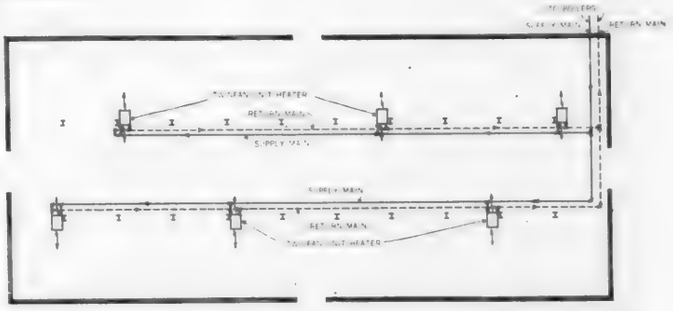
Scientific research has revealed startling differences in the control of air infiltration through windows and doors by various types of weather strips. This data, together with names of authorities responsible for it, is yours for the asking. Write for it.

MONARCH METAL PRODUCTS CO.
5060 Penrose Street, St. Louis, Mo.
Representatives in All Principal Cities

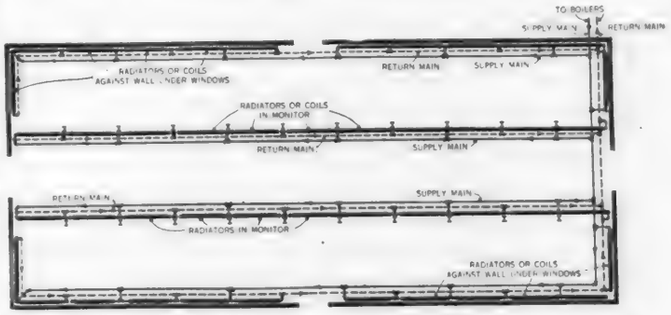
MONARCH
METAL WEATHER STRIPS
INTERLOCKING TYPE No. 400
STANDARD CONTROL OF AIR INFILTRATION

Which of these Jobs Would You Rather Install?

Look at these two steam piping layouts for the same building. Both provide adequate heat—one by the TWINFAN unit heater, the other by ordinary radiators. Which would you rather install?



The TWINFAN job would cost less so you might think it would produce less profit for you. But remember there's a difference between estimated profit and bank balances. The radiator job has a much larger labor cost than the unit heater installation because of the greater amount of piping, number of connections, etc. You



know how hard it is to estimate labor with as great accuracy as you do material. The chance of lost profit is therefore much greater in the radiator job.

Think it over. Test it out by referring your next factory or public garage inquiry to us.

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4534 W. NORTH AVE. CHICAGO, ILL.

Our Seven Decades of Experience–Combining Highest Engineering Talent, Modern and well Organized Facilities in Solving of Temperature Problems make unusual Economies Immediately and Permanently available in Your Plant

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Taylor Instrument Companies

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Canadian Plant

There's a *Tycos* or *Taylor* Instrument for Every Purpose — *Tycos* Building, Toronto, Canada

389

Sterlco
TRADE MARK

The Sterlco-Roys
TEMPERATURE CONTROL

The only Control in existence that regulates at the radiator without wall thermostats, air compressors and piping.

The most modern way of controlling room temperature.

Will maintain room temperature accurately at any degree from 60 to 80 deg.

Has been in use for the past eight years.

Costs one-fourth as much as other regulators.

Write for Bulletin No. 35.

THE STERLING ENGINEERING CO.
1630–44 Holton St.,
Milwaukee, Wis.

GOLD — HEATING & LIGHTING — NEW YORK

AUTOMATIC
HEAT REGULATION
ELECTRICALLY OPERATED

Packless Electric Valve

If you have a problem to solve in automatic temperature regulation, whether for a school, hospital room, or any other building, why not consult us? Electricity is always available.

Thermostat

WRITE FOR GENERAL CATALOG

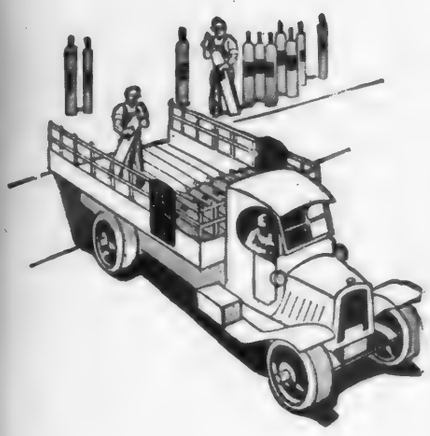
GOLD CAR HEATING & LIGHTING CO.
BUSH TERMINAL
220 36th STREET BROOKLYN, N. Y.

CENTRAL STATION STEAM CO.
2912 East Woodbridge St.
DETROIT, MICHIGAN

MANUFACTURERS OF
Cadillac Condensation Meters
Detroit Feed Water Meters

Packingless Expansion Joints and other special fittings for underground steam distribution mains.

What do YOU *get when you ask for* Linde Process Service?



LINDE PROCESS SERVICE is built to suit the needs of every Linde user. It is planned to help the smaller shop successfully weld a crank case, or to aid large companies in planning and laying hundreds of miles of welded pipe. It comprises the following divisions:

1. Books

Whenever the Linde Company in its field work finds a considerable group of its users struggling to solve the same welding or cutting problem, it plans to publish a book on the subject. These books enable you to help yourself and make it possible for every Linde man to give assistance.

2. Magazines

Two monthly magazines are published by the Linde Company. Both have the same aim: to keep Linde customers informed on the latest methods and to let them know how others are using the oxy-acetylene process to save time and money. "Oxy-Acetylene Tips" is edited for large users and "The Linde Oxwelder" is written to help smaller shops.

3. Service Operators

Perhaps you cannot find the help you need in the Linde books and magazines. A trained service operator may be needed to help locate the cause of trouble or demonstrate the proper methods. Service Operators are a part of Linde Process Service.

4. Service Supervisors

Your problem may be unique or very stubborn, demanding more experience or knowledge than the service operator can offer. Linde has men with these qualifications who are ready to serve you. They are called Service Supervisors.

5. Service Engineers

The solution of some problems requires more than a wide knowledge of process applications and an ability to use the blowpipe, because they involve some special engineering. That is why a group of Service Engineers are on the Linde staff, backing up the service men.

6. Consulting Engineers

Occasionally the economical and efficient use of the oxy-acetylene process requires that it be coordinated with other processes. This may require the highest type of engineering talent. When you need this kind of service the Linde Consulting Engineers are available.

7. Research Laboratories

Welding and cutting are primarily metallurgical problems. And that means that new methods and new processes must be tested by laboratory methods and be backed with engineering data. In this the Linde Company and you are served by the Union Carbide & Carbon Research Laboratories, Inc.

District Sales Offices

ATLANTA
BALTIMORE
BIRMINGHAM
BOSTON
BUFFALO
CHICAGO
CLEVELAND
DALLAS
DETROIT
KANSAS CITY
LOS ANGELES
MILWAUKEE
NEW ORLEANS
NEW YORK
PHILADELPHIA
PITTSBURGH
ST. LOUIS
SALT LAKE CITY
SAN FRANCISCO
SEATTLE
TULSA

Every Linde customer can use some part of this service regularly. Some problems may require the whole. Linde Process Service is flexible, and it is planned to fit your needs exactly. You don't want to waste time with the wrong service, so simply state your problem to any Linde man and the right service to fit the case will follow. Linde Process Service is free to every Linde user for the asking.

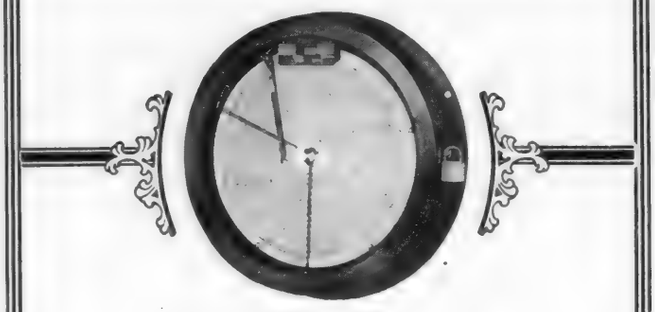
THE LINDE AIR PRODUCTS COMPANY

General Offices: Carbide & Carbon Building
30 East 42d Street, New York

37 PLANTS — 80 WAREHOUSES

LINDE OXYGEN

YOU CAN DEPEND ON THE LINDE COMPANY



Why More than 80%

of the Super-Power Plants Built in 1924 Are

FOXBORO EQUIPPED

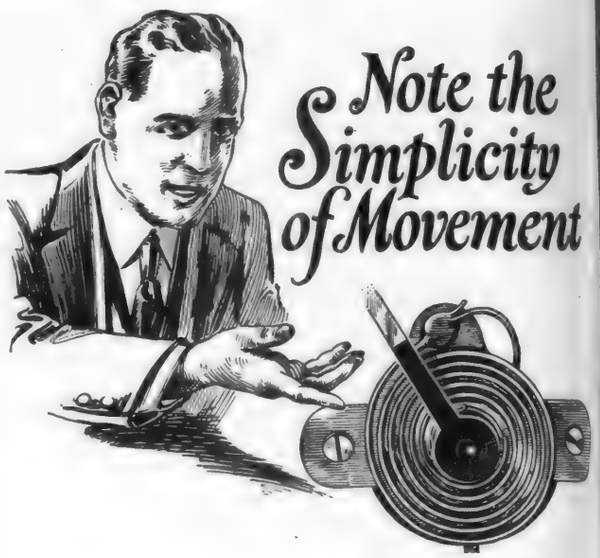
The engineers charged with building the biggest power plants of the country did not specify Foxboro indicating, recording, and controlling instruments without a reason.

It was a case of mature judgment —based on years of experience and an accurate knowledge of the laboratory accuracy, tempered-steel stamina and lifelong durability of Foxboro Instruments.

The judgment of these engineers is a safe guide for you to follow. Wherever temperature, pressure, humidity, CO_2, liquid level, time or motion must be measured it's a safe bet that Foxboro Instruments will best fit your requirements. Write for Bulletin R96-1.

THE FOXBORO CO., Inc.
Neponset Avenue, Foxboro, Mass. U. S. A.
New York Chicago Boston Philadelphia Pittsburgh
Cleveland Rochester Birmingham Tulsa
Los Angeles San Francisco Portland, Ore.

FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY 126



Note the Simplicity of Movement

One moving part is all there is in the Motoco Indicating Thermometer. No gears, screws, levers or hair springs. Nothing to get out of adjustment. Nothing to wear. Friction and vibration soon wear away cams, levers, etc., and seriously affect the accuracy of the reading.

The simplicity of the Motoco Dial Thermometer means greater accuracy, longer life, lower manufacturing cost. Therefore, you can buy the Motoco at less than half the cost of more complicated dial thermometers—at about the same price you'd have to pay for a hard-to-read armored glass tube thermometer of the better kind. And you can read the Motoco accurately at a distance of 20 ft.

Furnished with rigid stem or with up to 50 ft. of tubing, for any temperature between minus 40° and plus 750° F.

Write for a free copy of our Catalog No. 7.

MOTOCO
INDUSTRIAL THERMOMETER

The MOTO METER CO., Inc.
Industrial Thermometer Division
7 Wilbur Avenue
LONG ISLAND CITY, N. Y.
Made by the manufacturers of the famous Boyce Moto Meter

KENNEDY

Radiator Valves

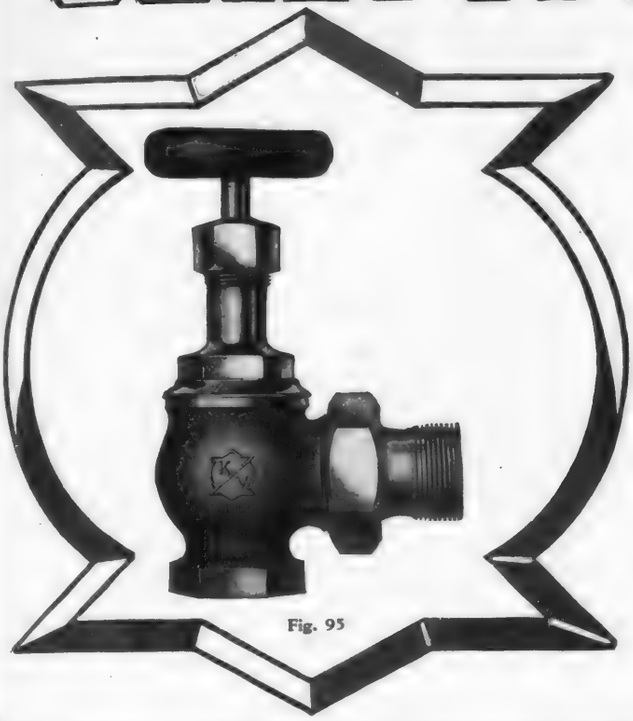


Fig. 95

THE uniformly reliable service of Kennedy Radiator Valves insures you against valve troubles of any nature. These valves come in every desirable type—straightway, angle, and offset corner, with or without unions, right or left hand, and with wheel or lock shield and key on operating stem.

The Kennedy products for domestic heating and sanitary lines cost no more than ordinary equipment, cause no trouble after being installed, stand more rough use, and last far longer.

The special features and advantages of Kennedy Valves are described in the Kennedy Catalog, listing over 4600 different types and sizes. Send for a copy.

THE KENNEDY VALVE MFG. CO., ELMIRA, N.Y.

Branch Offices and Warehouses
NEW YORK: 128-132 White St.
SAN FRANCISCO: 448-450 Tenth St.
BOSTON: 47 India St.
CHICAGO: 228 N. Jefferson St.

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EL PASO
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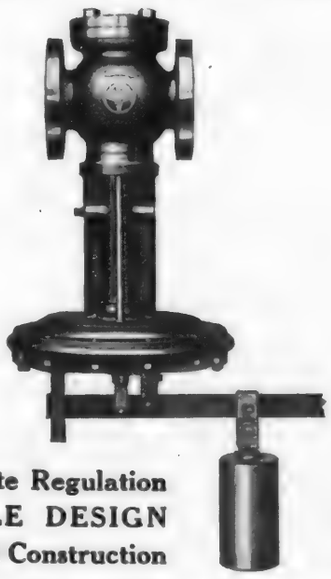
LOS ANGELES
PHILADELPHIA
MIAMI
CLEVELAND

USE A MASON

Lever Style Reducing Valve

on your next

HEATING CONTRACT



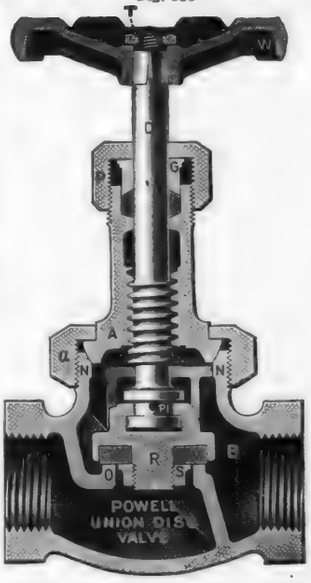
Accurate Regulation
SIMPLE DESIGN
Rugged Construction

MASON REGULATOR COMPANY

Boston, Mass. San Francisco, Cal. Montreal, Canada

POWELL VALVES

Fig. 150



Sizes ⅛ to 3 inches

UNION
COMPOSITE
DISC VALVES

ALWAYS
DEPENDABLE

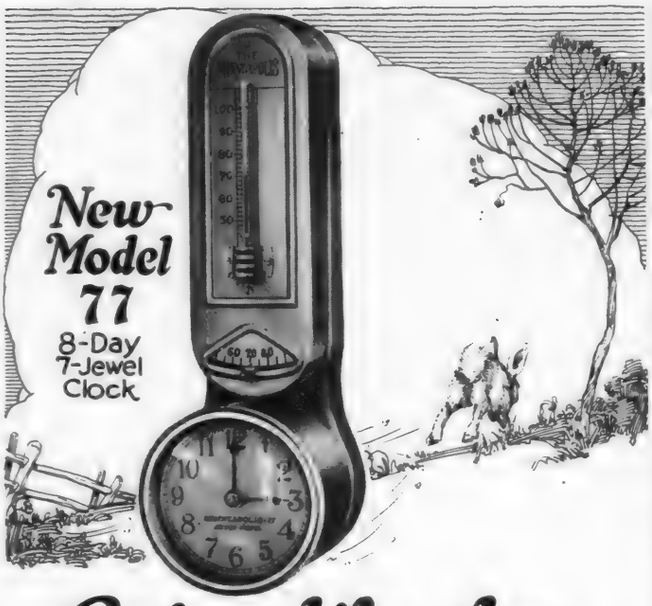
For Hot Water or Steam Heating

Notice the Union Bonnet Connection

Ask your dealer for Powll Valves

The Wm. Powell Company

Cincinnati, Ohio



Going like the Mad March Hare

Each month sees a greatly increased demand for the new Minneapolis Model 77 Thermostat with the Minneapolis-made 8-day, 7-jewel clock.

Literally—it's going like the mad March Hare. The reasons? We told you months ago the Model 77 would far surpass your highest expectations. The heating world knows how true this is. And, it has been quick to take advantage of this super-equipment for automatic heat regulation.

The "MINNEAPOLIS" HEAT REGULATOR

"The Heart of the Heating Plant"

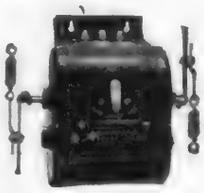
Here are a few of the many features that account for the phenomenal success of Model 77:

Improved clock made at the Minneapolis factory. Improved tripping mechanism, now entirely contained in clock. All clocks interchangeable. The entire mechanism is reduced to the utmost simplicity. More dependable. More accurate.

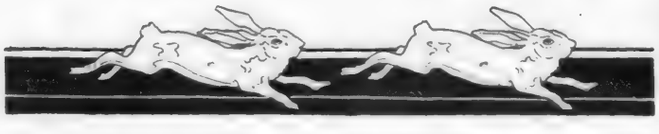
Model 77 raises efficiency standards for automatic heat control devices to a new high plane.

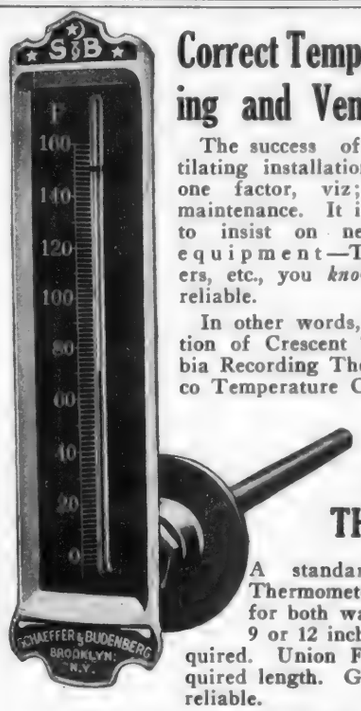
NEW ELECTRIC MOTOR

A fitting companion piece for the new 77 Thermostat. Completely enclosed. Very powerful. Underwriter approved. Write for complete information.



Minneapolis Heat Regulator Co.
Established 1885
2804 Fourth Ave., So.
Minneapolis, Minn.





Correct Temperatures in Heating and Ventilating Systems

The success of any Heating or Ventilating installation depends entirely on one factor, viz; proper temperature maintenance. It is your duty, therefore, to insist on necessary Thermometer equipment—Thermometers, Recorders, etc., you *know* to be accurate and reliable.

In other words, insist on the installation of Crescent Thermometers, Columbia Recording Thermometers, and Honeco Temperature Control.

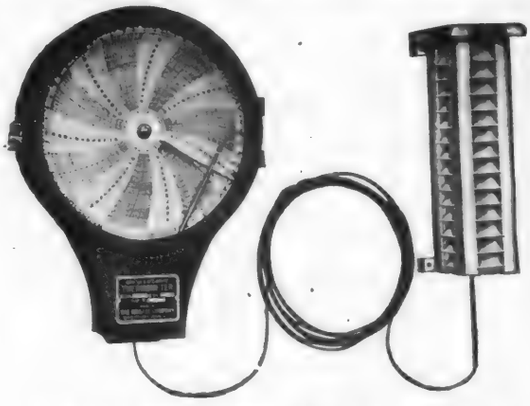
CRESCENT AIR DUCT THERMOMETER

A standard type of Crescent Thermometer specially designed for both warm and cold air ducts. 9 or 12 inch scale graduated as required. Union Flange and stem of required length. Guaranteed accurate and reliable.

Prices and Air Duct Bulletin F-14 on request.

American Schaeffer & Budenberg Corporation
BROOKLYN, N. Y.

* Boston * Chicago Detroit Tulsa
Buffalo Cleveland * Los Angeles Philadelphia
* Pittsburgh Salt Lake City * Seattle
* Stock carried at these branches
Direct Factory Representatives for Canada:
Mechanical Equipment Co., 902 New Birks Bldg., Montreal



BETTER RESULTS FROM HEATING AND VENTILATING SYSTEMS—

are induced by

TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE

Recording Instruments

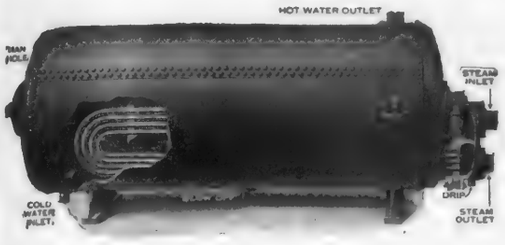
The illustration above shows Recording Thermometer suitable for taking outdoor atmospheric temperatures. It is provided with a long flexible connecting tube so that the instrument can be installed indoors and the sensitive bulb in a weather-house outside.

This is particularly suitable for apartment houses, hotels, public buildings including schools, theaters, municiple, etc.

By knowing the outside temperature at all times the engineer is able to regulate the indoor temperatures more closely.

Ask for copy of Bulletin No. N-303.

THE BRISTOL COMPANY
Waterbury, Connecticut



Patterson Combined Hot Water Service and Storage Heater—Type B.

Ready for Sudden Heavy Demands

This heater is adaptable to:

Clubs
Hotels
Apartment Houses
Association Buildings
Institutions
Bleacheries
Dye Houses
Canning Plants
Laundries
Paper and Pulp Mills
Textile Plants
Industrial Plants, etc.

Where the demands for hot water are not constant or where a large volume of water must be held in storage for sudden, heavy demands, the Patterson Combined Hot Water Service and Storage Heater fills the requirements. It operates with either live or exhaust steam—high or low pressure—automatically controlled, or in connection with low pressure, vacuum or vapor heating systems.

Our Engineering Service is offered without obligation, and the requirements of each installation are considered carefully before making recommendation as to type or capacity of the heater to be used.

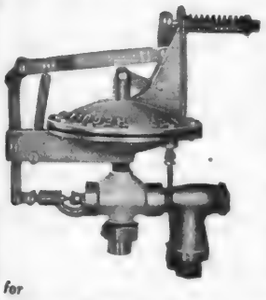
Where installations are made in accordance with our recommendations, we positively guarantee satisfactory hot water service.

Patterson-Kelley Co.,

Water Heating Engineers

107 E. 40th St. New York

A REMEDY FOR BALKY SYSTEMS



THE A & P AUTOMATIC HYDRAULIC VACUUM PRODUCER MAINTAINS CONSTANT VACUUM IN STEAM HEATING SYSTEMS

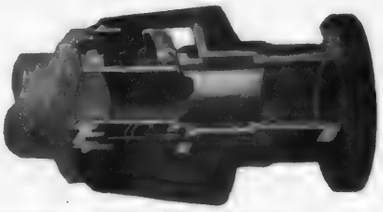
No tampering with air valves, foul air eliminated. No water hammering. Efficiency proved, merits investigation.

Ask for prices and Bulletin No. 1

for Churches, Schools, Residences, Theatres, Industrial Bldgs.

A & P REGULATOR CO., Park Ridge, Ill.

ROSS Crosshead-GUIDED Expansion Joint Excels in



Design, Construction and Workmanship
Over 60% of sales—Repeat Orders
Once Used—Always Demanded
Every Purchaser—A Customer

ROSS HEATER & MFG. CO., INC., BUFFALO, N. Y.

New York, Chicago, Philadelphia, Boston, Cleveland, St. Louis, Detroit, Pittsburgh, Baltimore, San Francisco, Seattle, Denver, Salt Lake City, Omaha, Montreal, Toronto.

The STICKLE Thermostatic Radiator Valve

The Expansion principle in return line Radiator Traps is not novel or new. Consequently the difference in this class of Traps is in the construction.

The expansive movement of this diaphragm is fully one-quarter inch, which is much more than is necessary for opening and closing the valve. This gives a factor of safety which is greater than any valve made, consequently it requires no adjustment. May we send you our bulletin?

STICKLE STEAM SPECIALTIES CO.
INDIANAPOLIS, IND.

New York Office
46 E. 41st St.

Boston Office
52 Sudbury St.

"Keeping Others In Hot Water"—

for
Hotels, apartment buildings, hospitals, Y. M. C. A. buildings, schools and laundries

Special Attention Given to Installations Requiring Large Quantities of Hot Water, with Live or Exhaust Steam as the Heating Medium.

—may be a pastime for some folks, but for the Sims Company it is a serious proposition—a matter requiring a thorough knowledge of hot water requirements.

A long study of these requirements enables us to offer heaters that assure constant and efficient hot water service.

Engineers feel safe in specifying "SIMS" because they know it means **reliability**—a service you want to render your client.

SIMS CLEAN E-Z STEAM TUBE STORAGE HEATER

Our Engineers will gladly confer with you, without obligation, on your hot water problems.

THE SIMS CO.

Erie, Pa.

A good place to live, to work and to play.

Stopping steam losses...

Whenever a heating or ventilating system is operating at a higher steam pressure than its absolute minimum, then is steam being wasted. The Davis Regulator cuts those excess pressures, reducing them to the economical level where they belong and keeping them there indefinitely with practically no attention.

You owe it to yourself to get acquainted with this proved steam saver. Get the free catalog. Address the G. M. Davis Regulator Co. at 436 Milwaukee Ave., Chicago.

1875—Valve builders for fifty years—1925

DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875

☐ Yes! send your new bulletin No. 5A on Damper Regulators

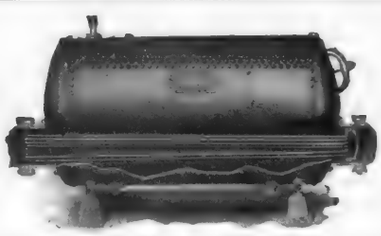
Just off the press. It completely covers all VICTOR high pressure, medium pressure, and low pressure Damper Regulators.

VICTOR damper regulators are made for all kinds of boilers—power plant, industrial plant, or house-heating. They are SOLD WITH AN ABSOLUTE GUARANTEE.

See complete list of Atlas Regulating Devices in classified directory, this issue.

The above is VICTOR No. 3; for pressures up to 250 lb.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South St., Newark, N. J



Alberger-Buffalo Storage Heaters have tubes the full length of tank which insures maximum heat transfer. Satisfaction guaranteed. Write for information on Alberger Multi Head Heaters and Howard Guided Expansion Joints.

ALBERGER HEATER COMPANY
HOWARD IRON WORKS
281-289 Chicago St. Buffalo, N. Y.

HV-3F-RTG

$2,000,000 Worth of EverHot Heaters Will Be Sold This Year by Plumbers and Heating Contractors

$2,000,000—a great and surprising figure. Especially surprising to those who do not know the history which lies behind it—and interesting to all who realize the future it promises.

Just five short years ago The EverHot Heater Company was practically unknown—a new concern with nominal capital, a rented plant—but with a new type of heater which was destined to revolutionize the automatic water heater industry.

EverHot sales have practically doubled every year from the first.

This unparalleled growth has not been due to "high finance," consolidating, super-merchandising—but is the direct result of making a very superior water heater and selling it at a volume price.

We enter 1925 with a distributing organization of high ability—and three times as large as a year ago; with a completely modern plant which can produce six times as many heaters as our plant of a year ago.

The Plumbing and Heating Trade of this country will easily sell $2,000,000 worth of EverHot Heaters in 1925. Get your share of this business.

Above: The New Quarter Million Dollar Plant Owned free and clear by the EverHot Heater company.

Below: View of the Assembling Department.

Principal Offices and Salesrooms Carrying Stock and Rendering Sales and Engineering Service

ARKANSAS: Pettit-Galloway Co., 114 E. Seventh St., Little Rock.
CALIFORNIA: EverHot Heater Sales Co., 1016 Santee St., Los Angeles.
CALIFORNIA: Robert Howden & Sons Tile Co., 1115 Webster St., Oakland.
CANADA: James Robertson Co., Ltd., Montreal, Quebec.
COLORADO: Steiner Bros., 235 15th St., Denver.
The Dennis Engineering Co.
GEORGIA: The Lowry Co., 29-31 S. Forsyth Ave., Atlanta.
IDAHO: W. D. Wilcox, Idaho Falls.
ILLINOIS: EverHot Heater Sales Co., 29 W. Lake St., Chicago.
ILLINOIS: EverHot Heater Sales Co., 234 S. Jefferson Ave., Peoria.
INDIANA: EverHot Heater Sales Co., 321 N. Pennsylvania Ave., Indianapolis.
INDIANA: Newman-Johnson Plumbing Co., 217 Locust St., Evansville.
IOWA: EverHot Heater Sales Co., 715 Grand Ave., Des Moines.
KENTUCKY: EverHot Heater Sales Company, 525 S. Third St., Louisville.
LOUISIANA: Plumbing & Heating Supply Co., 840 Baronne St., New Orleans.
MARYLAND: EverHot Heater Sales Co., 15 E. Fayette St., Baltimore.
MASSACHUSETTS: W. D. Cashin Company, 35 Hartford St., Boston (covering New England).
MICHIGAN: EverHot Heater Co., (Detroit Branch), 4460 Cass Ave., Detroit.
MINNESOTA: EverHot Heater Sales Co., 1316 Marquette Ave., Minneapolis.
MISSOURI: EverHot Heater Sales Co., 817 Walnut St., Kansas City.
MISSOURI: EverHot Heater Sales Co., 4133 Olive St., St. Louis.
NEBRASKA: EverHot Heater Sales Co., 2402 S. 10th St., Omaha.
NEW JERSEY: EverHot Heater Sales Co., 20 William St., Newark.
NEW YORK: EverHot Heater Sales Co., 54 Otis Place, Buffalo.
NEW YORK: EverHot Heater Sales Co., 212 East Ave., Rochester.
NEW YORK: EverHot Heater Sales Co., 1131 Kirkpatrick St., Syracuse.
OHIO: The Heilman-Eyster Engineering Co., Nicholas Building, Toledo.
OHIO: The Doermann-Roehrer Co., 450 E. Pearl St., Cincinnati.
OHIO: E. J. Hungerford Co., 1327 E. 105th St., Cleveland.
OHIO: The Dennis Engineering Co., 243 N. High St., Columbus.
OREGON: E. C. Rossman & Co., 135 Twelfth St., Portland.
PENNSYLVANIA: EverHot Heater Sales Co., 2401 Chestnut St., Philadelphia.
PENNSYLVANIA: EverHot Heater Sales Co., 132 N. Highland Ave., Pittsburgh.
SOUTH CAROLINA: The Gas Engine & Electric Co., 280 Meeting St., Charleston.
TENNESSEE: EverHot Heater Sales Co., Builders Exchange, Memphis.
TEXAS: Huey & Philp Hardware Co., Elm and Griffin Sts., Dallas.
TEXAS: Way Engineering Co., 1510 Main St., Houston.
UTAH: Williams & Derrah, 402 Scott Bldg., Salt Lake City.
WASHINGTON: EverHot Heater Sales Co., 310 Mutual Life Bldg., Seattle.
WISCONSIN: EverHot Heater Sales Co., 137 Oneida St., Milwaukee.

EverHot Heater Company

5215 Wesson Avenue **Detroit, Michigan**

BETTER HOT WATER SERVICE

LESS UPKEEP EXPENSE

The Interior Construction of the Wainwright Vertical Floating Head Service Heater

OFFERED either with smooth brass or corrugated tubes depending on conditions of service. Built in Vertical or Horizontal Patterns.

Temperature Control Furnished if Desired

Write for Bulletin

WHEELER CONDENSER & ENGINEERING CO.
149 Broadway, New York
Works - CARTERET, N.J., NEWBURGH, N.Y.

Easy to Sell to Oil Burner Users ~~~

Provides Many of the same advantages

Convenience —cleanliness—healthfulness —safety! Oil Burner users consider these qualities essential to their welfare. That is why they installed an oil burner. That is why they can easily be sold the Home Gas Incinerator.

It deals a death blow to the filthy garbage can and the messy rubbish barrel. Both vacate the premises when the Home Incinerator is installed. A sanitary back yard. A clean basement. These advantages have great weight with oil burner users.

The Home Gas Incinerator is elbow high. Feeds through a foot-wide top opening. Push a button and light it. Pull a lever and the ashes fall into a deep, galvanized bucket. Ingeniously constructed so garbage is dried out, then burned completely —2¾ bushels reduced to a pint of ashes. No smoke or odor. Economical to operate. Simple, NEEDS NO SERVICING. A real money-maker. Write today for full information.

Home Incinerator Company
209 Grand Ave. - - Milwaukee, Wis.

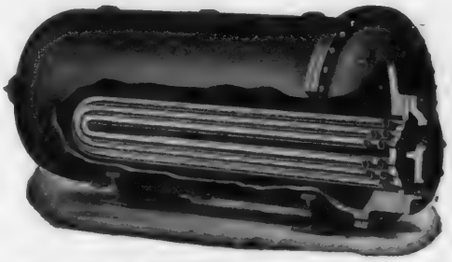
The Home IncineratoR

"I Try To Sidestep Trouble"

"Every time I install a **National** Storage Heater, **that** part of the job is off my mind for good.

"I've been up against some cranky customers, but I've never met one that kicked about first cost, upkeep, or service, when I put in a **National.**"

Bulletin 65 tells why it's real economy to use the National Storage Heater. May we send you a copy?



NATIONAL
U BEND TYPE
STORAGE HEATERS

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RADIATOR HANGER
YOU'LL USE 'EM YET!

THE hanger with *easier* lateral and vertical adjustments.

(Vertical adjustment made with ½" pipe.)

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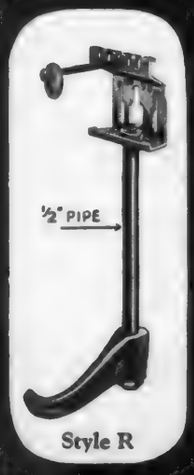
St. Paul - - - Minn.

"Ask em To Buy"



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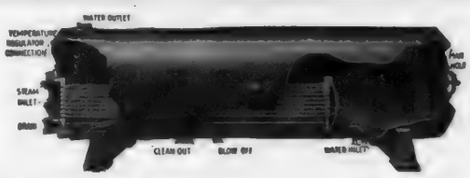


Most Dependable HOT WATER SERVICE

RUSSELL STORAGE HEATER

For Laundries, Apartment Houses, Hotels, Etc.

Write For Full Information

THE GRISCOM-RUSSELL COMPANY
2155 West Street Building
NEW YORK

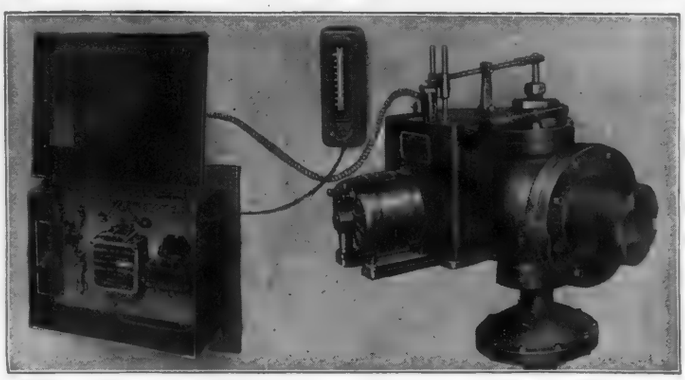
"Master Control" Saves Central Stations 35% to 60%

Read the following excerpts from an article by Mr. Woodworth in The Heating and Ventilating Magazine for September, 1924.

—H. A. Woodworth

(3014)

"To reach the most practical conclusions as to economy gained by automatic pressure temperature control, the writer made a series of tests, and the results showed savings of from 35% to 60%."



Hornung's "Master Control" Valve

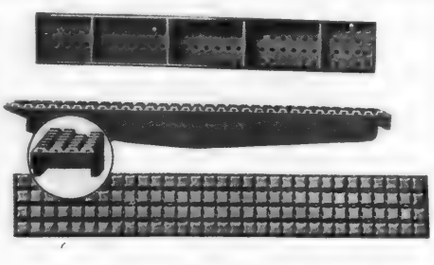
" 'Master Control' does not interfere with individual control of rooms or radiators. It means that radiation can and should be cut off 65% of the time when the outside temperature is 40°, the average temperature of our heating season. It means that the central station and the customer will benefit equally by controlling the heat down to actual requirements."

"The writer recommends that all heating companies stress the automatic temperature control, and thereby slow down the customers' meters at night and on mild days. The waste heat which they are selling to a dissatisfied customer at their lowest rate, could be sold to a new customer at a higher rate, thereby making two satisfied customers."

" 'Master Control' is particularly well adapted to Central Station heating, as it requires no attention at any time, being electrically controlled. Many of the central heating companies throughout the country are using this type of control, and recommending it to their customers. The cost of maintenance is negligible."

Central Heat Appliances *J. C. HORNUNG Engineer* **343 S. Dearborn St., Chicago**

Pyramid Grates and Forced Draft Equipment



have saved as much as 50% on fuel bills in many cases

Write us about your fuel bills and let us show you how we can reduce them

PYRAMID IRON PRODUCTS CORPORATION
136 Liberty Street :: :: NEW YORK CITY

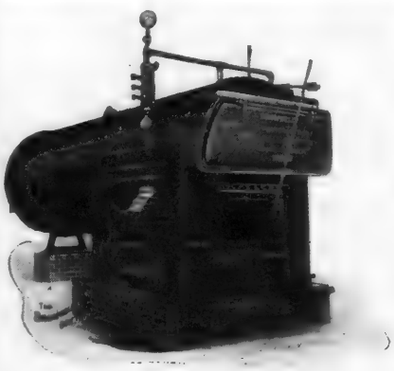
HEATING **POWER**

Stanwood Smokeless Boilers

HEATING CAPACITY
Steam—3300 Sq. Ft. to 25,000 Sq. Ft.
Water—5200 Sq. Ft. to 40,000 Sq. Ft.

NO MUD LEGS OR STAYBOLTS
LOW STACK TEMPERATURES
LOW WATER LEVEL—RAPID CIRCULATION

The Stanwood Corporation
CINCINNATI, OHIO
Successor to
THE HOUSTON STANWOOD & GAMBLE CO.



Brownell Return Flue Portable Heating Boiler—Smokeless Type

BROWNELL

Better Boilers for Heating and Power Purposes
70TH YEAR

of successful manufacturing experience. This is the reason why Brownell Boilers are specified by all the leading Heating and Contracting Engineers.

BROWNELL Steel Heating Boilers are
LOW IN FIRST COST
HIGH IN EFFICIENCY
BUILT TO LAST A LIFETIME

Our reputation is your insurance of a high quality product. Let us solve your heating problems. Sales representatives in all principal cities. Send for them.

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DAYTON, OHIO

THE BROWNELL COMPANY — The World Over — DAYTON, OHIO, U.S.A.

Established 1855

Send for Bulletins B6 B6A

BOILERS

A Few Users of RIC-WIL:

Buick Motor Co., Flint, Mich.
Imperial Oil Co., Dartmouth, Nova Scotia.
American Sugar Refining Co., Baltimore, Md.
Pullman Car Works, Pullman, Ill.
Cleveland Light, Heat & Power Co., Cleveland, O.
Windber Heating Co., Windber, Pa.
Central State Hospital, Nashville, Tenn.
Columbia University, New York City.

An installation of Ric-wiL Type DF. Insulation is molded to conduit and packed around pipes. High enduring efficiency.

A Sound Reason Why

THE engineer who designs and equips a power plant is not interested so much in how cheaply he can buy his equipment as in how cheaply that equipment will produce power and heat. The dividend to be earned is generally more important than the size of the investment.

And this applies equally to the means of steam transmission—underground conduit.

It is exactly because Ric-wiL Underground Conduit has proved its ability to return healthy dividends year after year that it was specified outright on more jobs during 1924 than ever before.

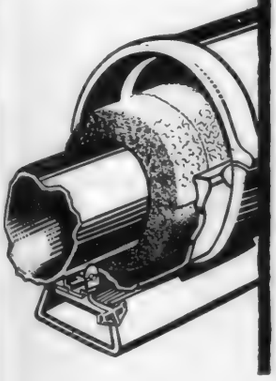
May we send you detailed evidence of the unusual qualities of economy and efficiency which Ric-wiL has? Write for it.

THE RIC-WIL COMPANY, CLEVELAND, OHIO

RIC-WIL
Economies No. 1

One of the installation savings of Ric-wiL lies in the fact that only one grading of the job is necessary.

When the bottom of the trench is graded, the grading is done. For Ric-wiL Base Drain follows the grade, Ric-wiL Conduit set on the base drain follows it, and so do the pipe supports, thus compelling the pipes to be in grade also.



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UNDERGROUND CONDUIT

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In Bound Volume

Here is an opportunity to secure the entire issue of Heating and Ventilating Magazine for the year 1924, in convenient form. Bound in one volume, with cross index.

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Stay-Rite All-Metal Radiator Traps and Valves are a good proposition for Jobbers, Contractor and user alike, because they are simple, profitable and sure.

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THE IDEAL HEATING EQUIPMENT CO.
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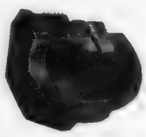
CLEVELAND, OHIO.

METERING RADIATOR BUSHINGS



Patent Allowed

proportion the steam to each radiator according to the pressure provided.

With them in the radiators

OPEN WINDOWS

cannot increase the steam condensed. Only as much steam will enter the radiators as the nozzle plugs will permit at the pressure supplied.

THE NOZZLE PLUG IS FIXED
THE OWNER VARIES THE PRESSURE.

What could be more simple?

It is just as economical as it is simple.

Write for literature

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VIRGINIA, MINN.

KIELEY
REGISTERED TRADE MARK

Steam, Water and Air Specialties

High Pressure Pilot Reducing Valve—300 lbs. to 10 lbs.

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Send for Catalog 1923

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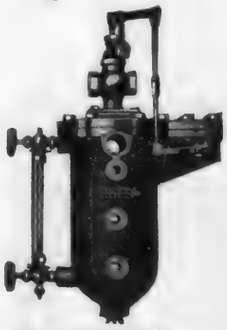

Automatic High Pressure Boiler Water Feeder

No Location is Difficult for a BADGER Installation

The location of an expansion joint is determined by necessity rather than choice. And many places do not allow an over abundance of room to work in. Sometimes the trench is of necessity not much larger than the pipe itself, and in many cases a trench or tunnel must accommodate several pipe lines.

The installation below of a Badger Self-Equalizing Expansion Joint shows how easily all the difficulty of limited space are overcome when Badger Expansion Joints are used. They are merely bolted in place just as if they were a small section of the pipe itself.

No leaks, no packing, no adjusting, no further attention.

Badger Expansion Joints are serving some of the largest steam jobs in the country. Let our engineers tell you more about them and advise you in your expansion problems.

E. B. BADGER & SONS COMPANY

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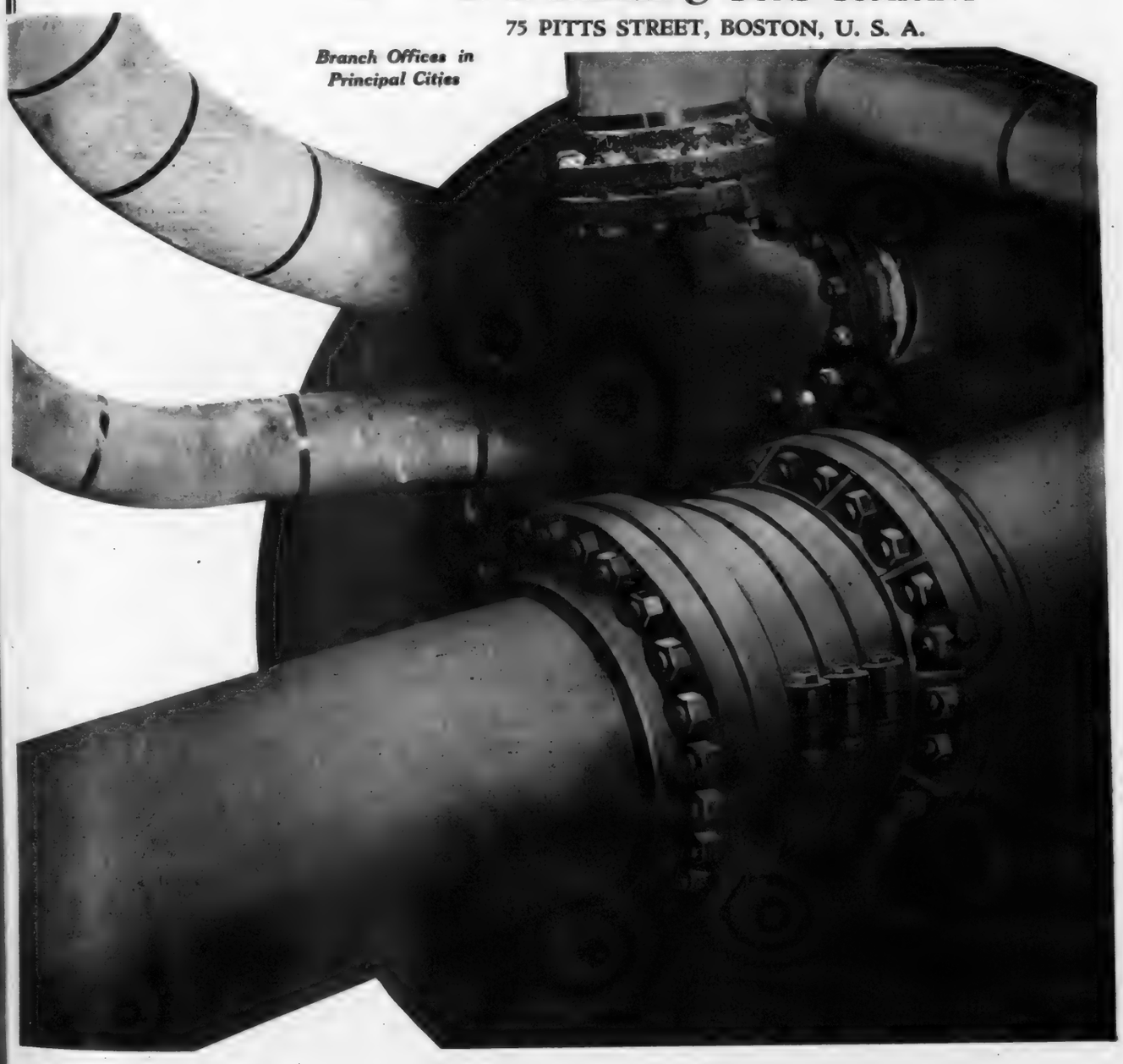

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.

Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc., W. L. New York.
Grinnell Company, Providence, R. I.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Filters, Inc., New York.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLING AND DRYING SYSTEMS.

Aerofin Corp., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc. W. L. New York.
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Massachusetts Blower Co., Watertown, Mass.
Midwest Air Fifters, Inc., New York.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.

Jas. P. Marsh & Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Midwest Air Filters, Inc., New York.

AIR FILTERS.

Midwest Air Filters, Inc., New York.
Reed Air Filter Co., Inc., Louisville, Ky.

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Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.

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Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower Co., Inc., New York.
Fleisher Co., Inc., W. L. New York.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.

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Fan.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

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American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.

Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Turbine.

Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

BOILER CEMENT.

Johns-Manville, Inc., New York.

BOILERS.

Down-Draft.

American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
General Boilers Co., Waukegan, Ill.
Hart and Crouse, Utica, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Stanwood Corporation, Cincinnati, Ohio.

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Continental Heater Corp., Dunkirk, N. Y.
Cox Stove Co., Abram, Philadelphia, Pa.
General Boilers Co., Waukegan, Ill.
Gorton & Lidgerwood Co., New York.
Grinnell Company, Providence, R. I.
Gurney Heater Mfg. Co., Boston, Mass.
Heggie Simplex Boiler Co., Joliet, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co., Utica, N. Y
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Newport Boiler Co., Chicago, Ill.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Ross Boiler Co., Chicago, Ill.
Stanwood Corporation, Cincinnati, Ohio.
Thatcher Furnace Co., Newark, N. J.
Titusville Iron Works, Titusville, Pa.
Utica Heater Co., Utica, N. Y.
Wayne Heater Corp, Richmond, Ind.
Weil-McLain Co., Chicago, Ill.

Power.

Heggie Simplex Boiler Co., Joliet, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Ross Boiler Co., Chicago, Ill.
Stanwood Corporation, Cincinnati, Ohio.
Titusville Iron Works Co., Titusville, Pa.

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American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Sarco Co., New York.

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American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Simmons Co., John, New York.

Air.

New York Blower Co., Chicago, Ill.

CONDENSERS.

Alberger Heater Co., Buffalo, N. Y.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

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Patterson-Kelley Co., New York.
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Wyckoff & Son Co., A., Elmira, N. Y.

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Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

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Cooling Tower Co., Inc., New York.

COPPER BOILERS

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COPPER KETTLES

Dahlquist Mfg. Co., Boston, Mass.

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Hornung, J. C., Chicago, Ill.
Johns-Manville Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

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Buckeye Blower Co., Columbus, O.

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Fleisher Co., Inc., W. L., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

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Griscom-Russell Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.

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Simmons Co., John, New York.
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(See Air Cooling and Drying Systems.)

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Buffalo Forge Co., Buffalo, New York.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

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Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Co., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

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Hill, E. Vernon Co., Chicago, Ill.

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Steam, Automatic.

American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Stanwood Corporation, Cincinnati, Ohio.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.

American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
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Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

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Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wing Mfg. Co., L. J., New York.

EXHAUST HEADS.

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Patterson-Kelley Co., New York.
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Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wright-Austin Co., Detroit, Mich.

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Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Dahlquist Mfg. Co., Boston, Mass.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.

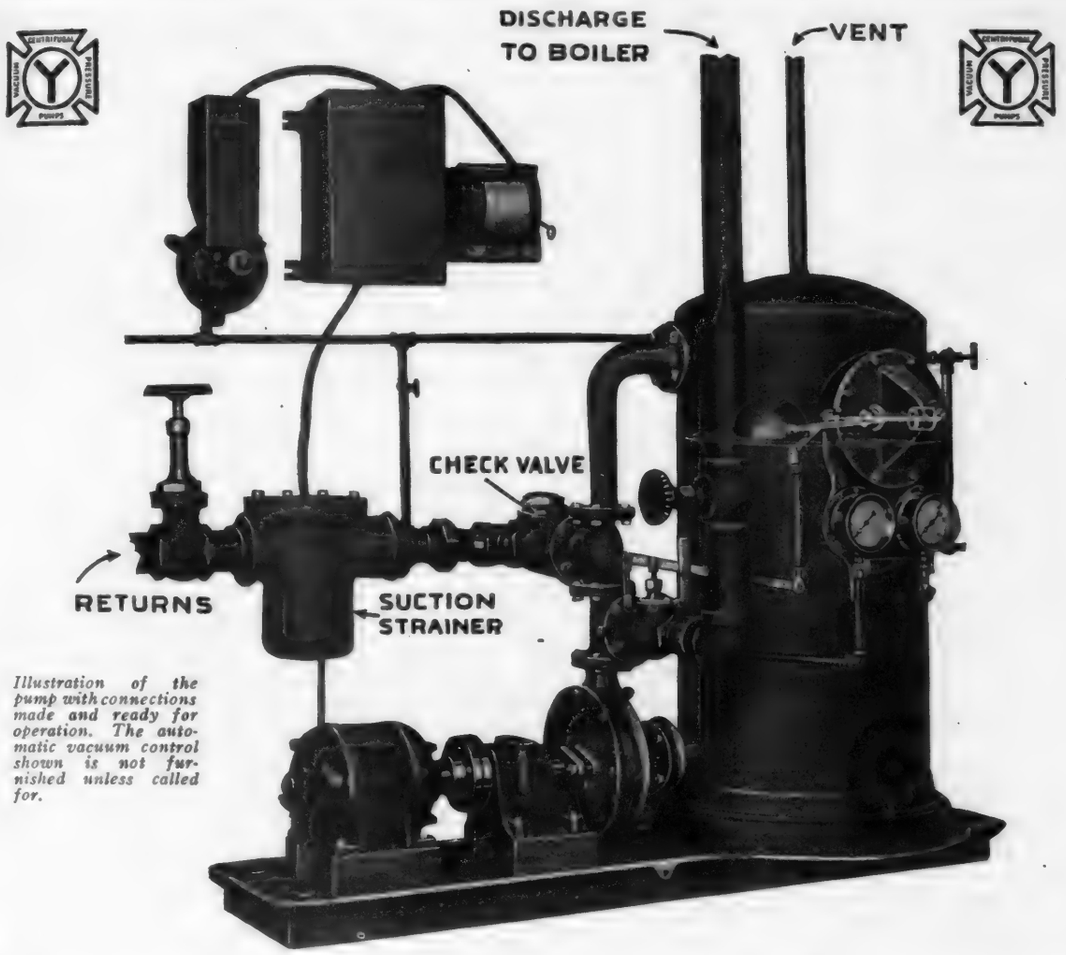

Illustration of the pump with connections made and ready for operation. The automatic vacuum control shown is not furnished unless called for.

Young Vacuum Pumps

Powerful
Economical
Sturdy
Simple
Foolproof
Completely Assembled

The Engineer and Architect will appreciate the many advantages of the new "V" construction of the Young Centrifugal Vacuum and Boiler Feed Pumps. Their air and water capacity is ample. Each Pump is guaranteed to handle the air and condensate of its rated capacity and to produce in a properly laid out and equipped vacuum system 10 inches of vacuum with a temperature of return water not to exceed 180 degrees.

In ease of installation—simplicity of operation—low cost of maintenance—freedom from trouble—Young Pumps excel.

Descriptive bulletin upon request.

Young Vacuum Pumps are *now* produced by an organization whose ideal and endeavor is the attainment of the best in construction and results in service. The service of this organization is nation-wide.

YOUNG PUMP COMPANY 230 East Ohio Street, Chicago

Factory: Michigan City, Indiana

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Illinois Engineering Co., Chicago, Ill.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.
Wheeler Condenser & Engineering Co., Carteret, N. J.

FANS, EXHAUST.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

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Boiler.

Kieley & Mueller, Inc., New York.
McDonnell & Miller, Chicago, Ill.

FILTERS, (Aerating).

Griscom-Russell Co., New York.

Feed-Water.

Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED.

American District Steam Co., No. Tonawanda, N. Y.
Clow & Sons, Jas. B., Chicago, Ill.
Grinnell Company, Providence, R. I.
Simmons Co., John, New York.

FLANGES.

American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.

FLOOR SLEEVES.

Farley Sleeve & Hanger Co., Cleveland, Ohio.

GAS BURNERS.

Cleveland Gas Burner & Appliance Co., Detroit, Mich.

GASKETS, METALLIC.

Sarco Co., New York.

GAUGE BOARDS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.

Altitude.

Pierce, Butler & Pierce Corp., New York.

Draft.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Hydraulic.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Ounce Graduated.

Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.

Pressure.

American Dist. Steam Co., North Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Bristol Co., Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Bishop & Babcock Co., Cleveland, Ohio.

Vacuum.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum (Compound).

Cashin Co., W. D., Boston, Mass.
Pierce, Butler & Pierce Corp., New York.

Water.

American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bristol Co., Waterbury, Conn.
Jenkins Bros., New York.

GENERATOR COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

GOVERNORS, (Pump).

Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRATES.

Dumping.

Pyramid Iron Products Co., New York.

Rocking.

Pyramid Iron Products Co., New York.

Shaking.

Pyramid Iron Products Co., New York.

Shaking and Dumping.

Pyramid Iron Products Co., New York.

Shaking, Circular.

Pyramid Iron Products Co., New York.

Stationary.

Pyramid Iron Products Co., New York.

HEATERS.

Domestic Water.

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Dahlquist Mfg. Co., Boston, Mass.
Everhot Heater Co., Detroit, Mich.
Excelso Specialty Works, Buffalo, N. Y.
National Pipe Bending Co., New Haven, Conn.
Page Boiler Co., Wm. H., New York.
Patterson-Kelley Co., New York.
Pierce, Butler & Pierce Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Thermal Appliance Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Closed).

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims Co., Erie, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Open).

Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.

Alberger Heater Co., Buffalo, N. Y.
American Blower Co., Detroit, Michigan.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

Air, Fan System

Aerofin Corporation, Newark, N. J.
American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Portable Unit Air.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Pecco Incorporated, St. Louis, Mo.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass
L. J. Wing Mfg. Co., New York.
(See also Ventilators, Portable Unit.)

HEATING SYSTEMS.

"Gasteam"

James B. Clow & Sons, Chicago, Ill.

Vacuum.

Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Vapor.

American District Steam Co., No. Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Grinnell Company, Providence, R. I.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane & Co., La Crosse, Wis.
Vapor Heating Co., York, Pa.
Webster & Co., Warren, Camden, N. J.

Water.

Grinnell Company, Providence, R. I.
Thrush & Co., H. A., Peru, Ind.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Grinnell Company, Providence, R. I.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

HUMIDITY CONTROL.

American Blower Co., Detroit, Mich.
Atlas Valve Co., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Foxboro Co., Inc., The Foxboro, Mass.
Grinnell Company, Providence, R. I.
Klipfel Mfg. Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

INCINERATORS.

Home Incinerator Co., Milwaukee, Wis.

INSTRUMENTS.

Electric Measuring.

Bristol Co., Waterbury, Conn.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bailey Meter Co., Cleveland, O.
Foxboro Co., Inc., The Foxboro, Mass.
Hill, E. Vernon Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Union Fibre Co., Winona, Minn.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Co., New York.

METERS.

Condensation.

American Dist. Steam Co., No. Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.

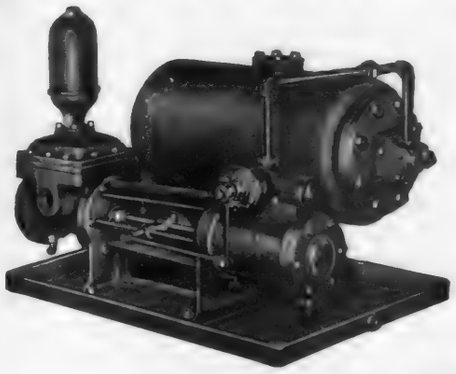
Feed Water.

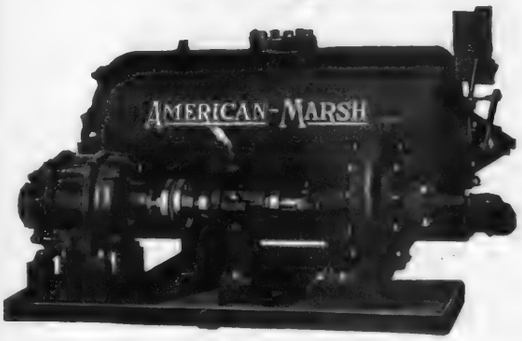
Central Station Steam Co., Detroit, Mich.
Simmons Co., John, 110 Center St., New York.

Feed Water (Wier Type).

Webster & Co. Warren, Camden, N. J.

AMERICAN-MARSH CONDENSATION PUMPS





Steam and Motor Driven

The American-Marsh line of pumps for heating systems includes:

Boiler Feed Pumps

Vacuum Pumps, steam and motor driven

Hot Water Circulating Pumps

Sump or Bilge Pumps

Condensation Pumps, steam and motor driven, vertical and horizontal

Automatic Boiler Feed Pumps and Receivers

American-Marsh Pumps are the result of over 35 years experience in the building of high grade pumping machinery. There are over 165,000 in actual operation. Every pump is made with only the very best of material and workmanship and combine reliability with highest efficiency.

Ask for bulletins covering the types in which you are interested.

AMERICAN STEAM PUMP COMPANY, BATTLE CREEK, MICH.

"CHICAGO" PUMPS

Give You
HIGH QUALITY at a REASONABLE COST

"SURE RETURN" CONDENSATION PUMP
Ask for Bulletin 47.

The best workmanship and finest materials obtainable are used in building "Sure Return" Condensation and "L-1" Bilge Pumps — yet we are able to sell them at very low prices.

Hundreds of each size are put through our modern shop at one time—but each unit gets individual care and inspection. Thus you are assured of a reasonably-priced, proper working outfit.

Try a "Chicago" pump on your next hard job. You will like the result.

"L-1" BILGE PUMP
Ask for Bulletin 48

CHICAGO PUMP CO.

2332 Wolfram Street **Chicago, Ill.**

ENGINEERS' SPECIFICATION INDEX (Continued)

METERS—(Cont'd)

Pitot Tube.
American Blower Co., Detroit, Mich.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.

MOTORS (Electric).
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

OZONE APPARATUS.
Ozone Pure Airifier Co., Chicago, Ill.
United States Ozone Co., Scottdale, Pa.

PIPE.

Cast Iron.
Clow & Sons, Jas. B., Chicago, Ill.

Soil.
Simmons Co., John, 110 Center St., New York.

Steel.
National Tube Co., Pittsburgh, Pa.
Simmons Co., John, 110 Center St., New York.

Wrought Iron.
Simmons Co., John, 110 Center St. New York.

Wood.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.
Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Grinnell Company, Providence, R. I.
National Pipe Bending Co., New Haven, Conn.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, (Wood).
American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE HANGERS.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE, POWER.
Grinnell Company, Providence, R. I.
Simmons Co., John, New York.

PUMPS.

Centrifugal.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Condensation.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

Rotary.
Nash Engineering Co., So. Norwalk, Conn.

Steam.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.

Turbine.
Nash Engineering Co., So. Norwalk, Conn.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yoemans Bros., Chicago, Ill.

Vacuum.
American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Chicago Pump Co., Chicago, Ill
Economy Pumping Machinery Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
McAlear Mfg. Co., Chicago, Ill
Nash Engineering Co., So. Norwalk, Conn.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Skidmore Corp., Chicago, Ill.
Trane Co., La Crosse, Wis.
Weinman Pump Mfg. Co., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros. Chicago, Ill.
Young Pump Co., Michigan City, Ind.

RADIATOR BUSHINGS

Metering
Holley Engineering Co., Virginia, Minn.

RADIATOR COVERS
Acme Radiator Shield Co., Cincinnati, Ohio.

RADIATOR HANGERS.
Farley Sleeve & Hanger Co., Cleveland, Ohio.
Gloeckle, Jr., A. F., Rochester, N. Y.
Grinnell Company, Providence, R. I.
Healy-Ruff Co., Minneapolis, Minn.
Pierce, Butler & Pierce Mfg. Co., New York.

RADIATORS

"Gasteam"
James B. Clow & Sons, Chicago, Ill.

"Gaswater."
Clow & Sons, Jas. B., Chicago, Ill.

RADIATORS, STEAM AND WATER.
Aerofin Corp., Newark, N. J.
American Radiator Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Gurney Heater Mfg. Co., Boston, Mass.
Lyon Products Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Simmons Co., John, New York.

RECEIVERS.

Air.
American District Steam Co., No. Tonawanda, N. Y.
The Brownell Co., Dayton, O.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.
Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago. Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Yeomans Bros., Chicago, Ill.

REGULATORS.

Boiler-Feed.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Thrush & Co., H. A., Peru, Ind.
Wright-Austin Co., Detroit Mich.

Damper.
American Dist. Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago, Ill.
Bishop & Babcock Co., Cleveland, Ohio.
Davis Regulator Co., G. M., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Co., Chicago, Ill.
Nelson Co., H. W., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburgh, Va.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Thrush & Co., H. A., Peru, Ind.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

Pressure.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Foxboro Co., Inc., The Foxboro, Mass.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Taylor Instrument Cos., Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.

Temperature.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Carrier Engineering Corporation, Newark, N. J.
Elliott Co., Jeanette, Pa.
Foxboro Co., Inc., The Foxboro, Mass.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

SEPARATORS.

Oil.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Wright-Austin Co., Detroit, Mich.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SPRAY COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Massachusetts Blower Co., Watertown, Mass.

SPRINKLER HEADS.
C. S. B. Sprinkler Co., Boston, Mass.

STRAINERS.

Oil.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.

Steam
American Dist. Steam Co., No. Tonawanda N. Y.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeannette, Pa.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Mason Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Wright-Austin Co., Detroit, Mich.

Water
American Dist. Steam Co., No. Tonawanda, N. Y.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sarco Co., New York.

THERMOMETERS.

(Recording and Indicating.)
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
Moto Meter Company, Inc., Long Island City, N. Y.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

Water
Marsh & Co., Jas. P., Chicago, Ill.
Pierce, Butler & Pierce Corp., New York.

THERMOSTATS.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Fulton Co., Knoxville, Tenn.
Johnson Service Co., Milwaukee, Wis
Klipfel Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Thrush & Co., H. A., Peru, Ind.

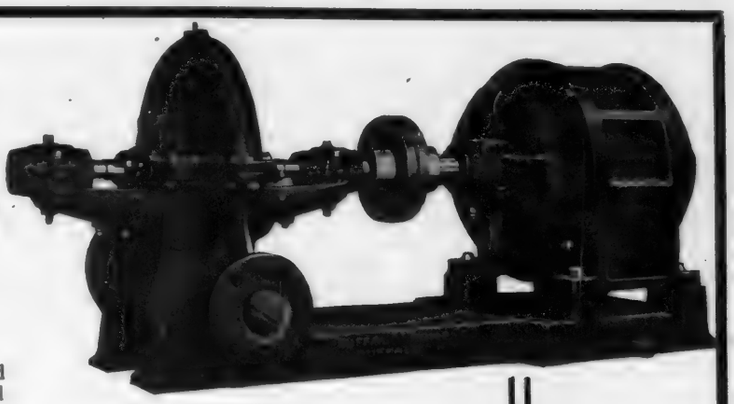
TRAPS.

Radiator.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dole Valve Co., Chicago, Ill.
Dunham, C. A., Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

Return.
American Blower Co., Detroit, Mich.
Barnes & Jones, Boston, Mass.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

Steam.
American Blower Co., Detroit, Mich.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.

8 Reasons for Specifying "Buffalo" Class "S" Pumps–



1. **Casing:** Horizontally divided;—mounted directly on base. Interior can be inspected without breaking pipe connections.
2. **Impeller:** Enclosed double suction type, hydraulically balanced.
3. **Clearance Rings:** Brass. Furnished in casing. Easily renewable.
4. **Shaft Bearings:** Ring oiling, horizontally split housings. Brackets bolted to casing, one on each side.
5. **Thrust Bearings:** Collars in each bearing of smaller pumps, marine type on larger sizes.
6. **Stuffing Boxes:** Extra deep. Brass bushed in smaller sizes.
7. **Glands:** Bolted type.
8. **Water Seals:** Brass. Furnished in each stuffing box. Connections cast in casing in smaller sizes.

Why not find out more about these pumps? Bulletins on request.

Buffalo Steam Pump Company
480 Broadway **Buffalo, N. Y.**

ALL KINDS PUMPS EVERY SERVICE

The New "WEINMAN" TYPE "HH" AUTOMATIC CENTRIFUGAL VACUUM AND BOILER FEED UNITS

Made in All Sizes; Standard Boiler Pressure 20 lbs.

Write for Bulletin 200

Patented 10-16-23

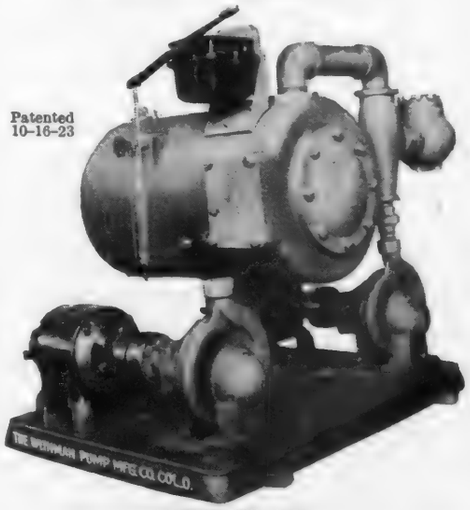


FIGURE NO. 525

THE WEINMAN PUMP MFG. CO.
Columbus, Ohio

YEOMANS

YEOMANS PUMPS GIVE YEOMAN SERVICE

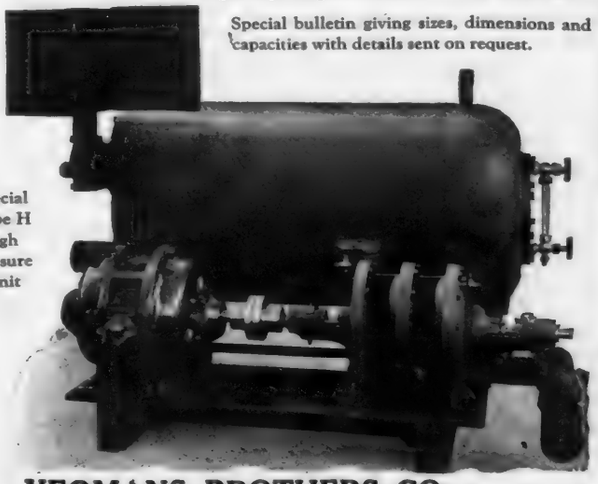
CONDENSATION PUMPS

The mark of Dependability

Built for all pressure and capacity requirements

AUTOMATIC ELECTRIC NOISELESS RUGGED

Special bulletin giving sizes, dimensions and capacities with details sent on request.



Special Type H High Pressure Unit

YEOMANS BROTHERS CO.
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DEPENDABILITY

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Klipfel Mfg. Co., Chicago, Ill.
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Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
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Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

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Griscom-Russell Co., New York.
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Simmons Co., John, New York.

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Grinnell Company, Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
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McAlear Mfg. Co., Chicago, Ill.
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Powell Co., Wm., Cincinnati, O.
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Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powell Co., Wm., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.

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Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.

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McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, Ohio.

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American District Steam Co., No. Tonawanda, N. Y.
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Jenkins Bros., New York.
Powell Co., Wm., Cincinnati, O.

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(See Valves, Non Return.)

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Peerless Unit Ventilating Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

(See also Heaters, Portable Unit Air.)

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Atmospheric Conditioning Corp., Phila., Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
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Nesbitt, John J., Inc., Atlantic City, N. J.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilating Co., New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

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Allen Air-Turbine Ventilator Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

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Higgin Manufacturing Co., Newport, Ky.
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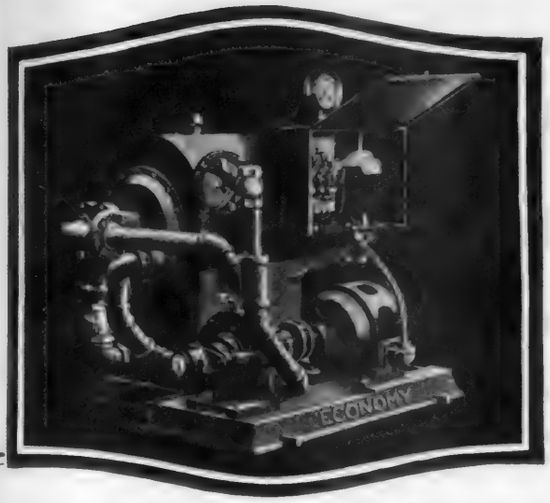

Type C. V. Fig. 2234—Single Model Vacuum Pumps

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Economy Centrifugal Vacuum Pumps

embody every requisite of high class equipment. They are well motored with ample reserve power. They never burn out, consequently shut downs are avoided.

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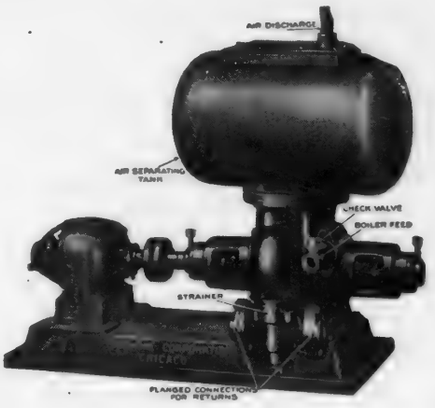
SKIDMORE HYDRO TURBINE VACUUM AND BOILER FEED PUMP



SET THEM AS THEY COME CONNECT RETURNS, WIRE MOTOR AND RUN

Operates on a different principle.

Simple, Efficient and Sure.

Manufactured of highest grade material along lines of best engineering practice.

All parts are accurately machined.

The base, casing, bearing brackets and tank are fine-grained cast iron.

The shaft is Tobin Bronze carried on heavy ball bearings.

The air rotor and centrifugal pump are bronze castings.

The Skidmore occupies half the floor space required for other makes of pumps.

A self-contained unit requiring no piping.

Engineers requiring the best and wanting a pump, the high efficiency of which remains constant, should specify the Skidmore.

Bulletin No. 2 will be sent on request.

Built in five sizes for 10 and 20 lbs. pressure to handle 8000, 16000, 26000, 40000, and 65000 sq. ft. of radiation, for continuous service or with automatic control.

SKIDMORE CORPORATION

General Offices and Factory

1535 Dayton St. CHICAGO, U. S. A.

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Save Coal—Prevent Condensation

Insulate All Roofs

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Contractor: Phillip Kitzer, Cleveland, Ohio.

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The widespread preference for Oil City Boilers by the educational institutions of the country is evidence of confidence in Oil City service.

"Safety first" then efficiency and maintenance does seem to mean "Oil City".

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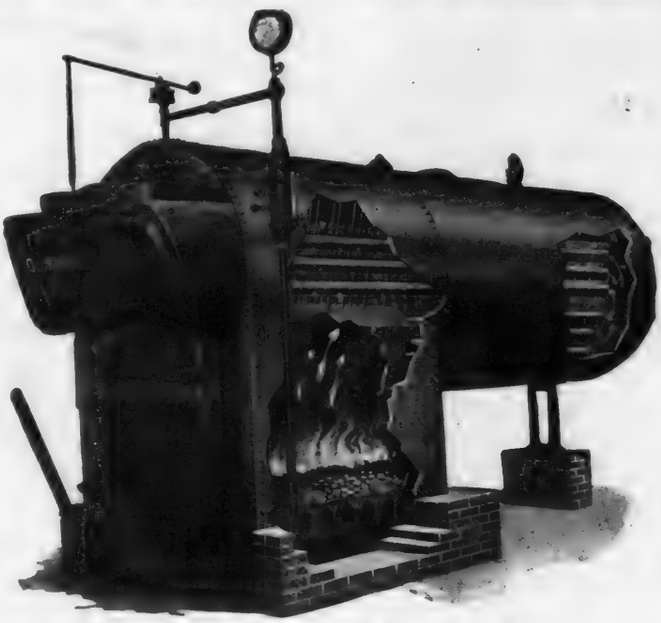

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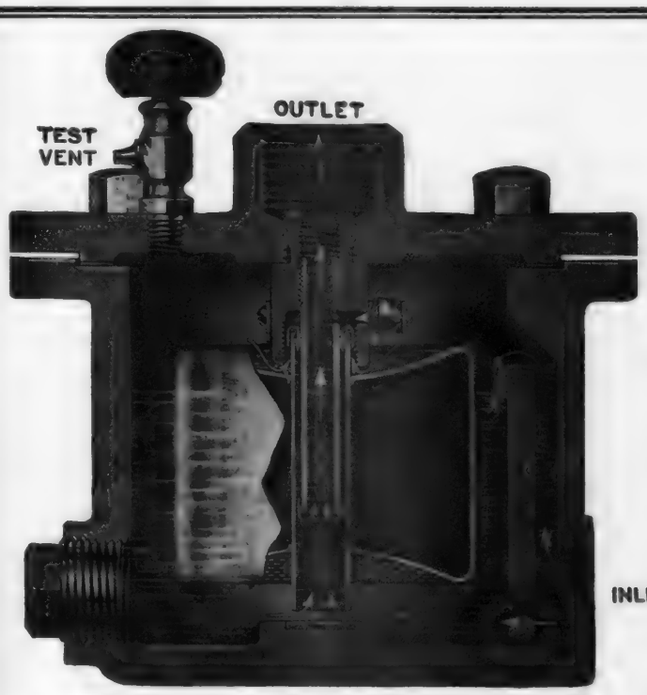
NEW YORK CHICAGO PITTSBURGH ATLANTA PHILADELPHIA LOS ANGELES



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DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

for direct or indirect coils or any location where large quantities of water are to be discharged

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

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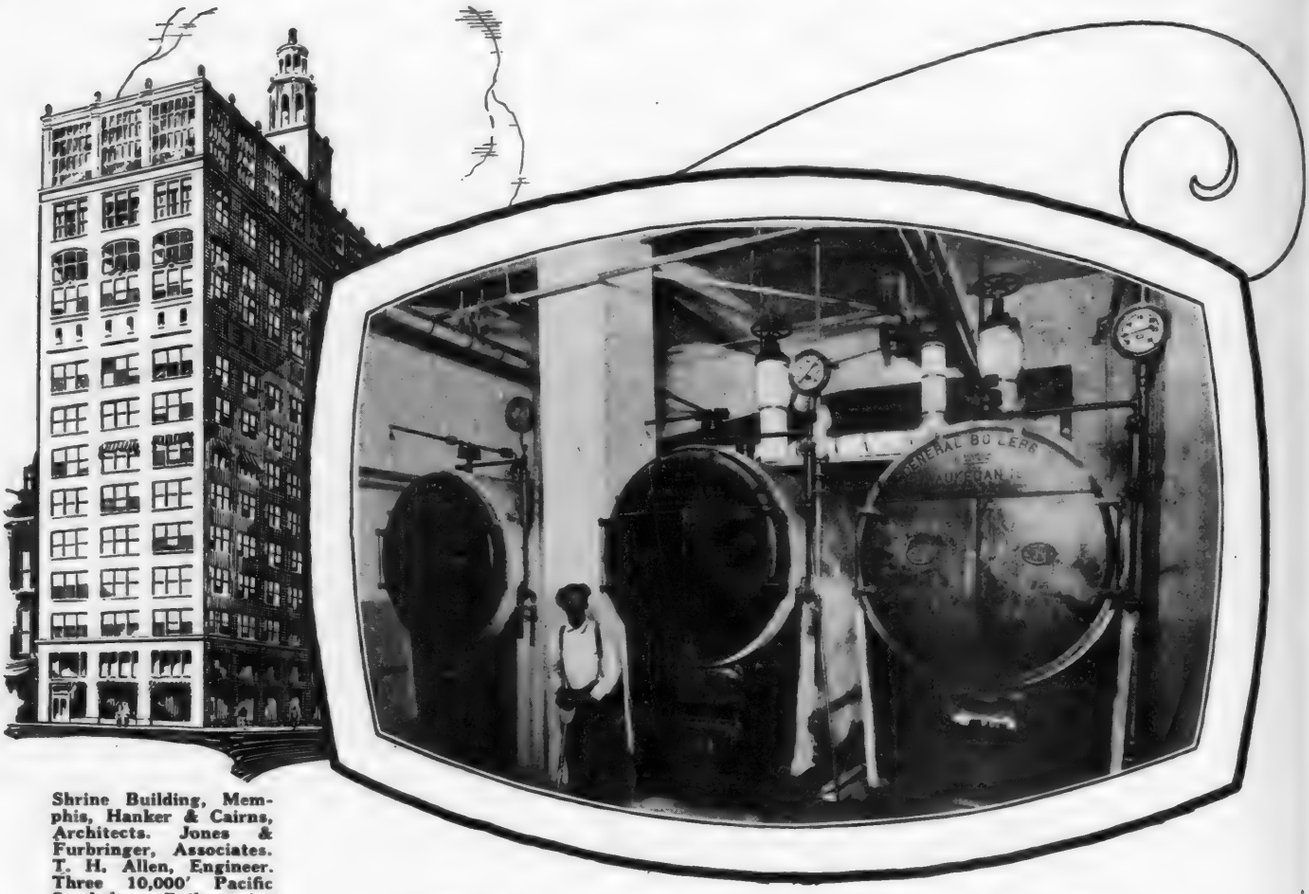

Shrine Building, Memphis, Hanker & Cairns, Architects. Jones & Furbringer, Associates. T. H. Allen, Engineer. Three 10,000′ Pacific Smokeless Boilers installed by Fisher Heating Co.

This photograph tells you

Three important facts about Pacific Boilers

First, note the compactness of the installation—three 10,000′ Pacific Steel Smokeless Boilers installed in a boiler room only 19′ deep, 26′ wide. *Pacific Boilers save 25 to 40 per cent of the floor space over other boilers of equal capacity.*

These Pacific Boilers are placed close to the rear wall—all tubes are cleaned from the front. What is the result? Many feet of boiler room space are saved. Still all tubes are quickly and easily cleaned while the boiler is in operation—an important feature not found in other type boilers.

The second big feature of the installation shown here is the remarkable overload capacity of Pacific Boilers. Note that steam is up in only one boiler—to the right. Three boilers were installed—30,000′ capacity. Yet only one boiler has been required to heat the building satisfactorily. *Certainly here is convincing proof that Pacific ratings are conservative.*

The third point is ease of operation. Look at the photograph, observe the man in charge of the boiler room. *It doesn't take an engineer or a husky coal heaver to handle Pacific Boilers.* They are built right—satisfactory in every way. Write for illustrated bulletin.

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STEEL HEATING BOILERS

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Five Boilers in Two Buildings
Two Pairs and a Lone Ace

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The large water content, proportionate steam space and disengaging area assure steady steaming

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St. Louis, Missouri
Heated by

Two No. 320 Kewanee Smokeless Down-Draft Boilers, 15 lbs.
Two No. 317 Kewanee Smokeless Down-Draft Boilers, 15 lbs.
One No. 310 Kewanee Smokeless Down-Draft Boiler, 100 lbs.

KEWANEE BOILER COMPANY

KEWANEE, ILLINOIS

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Gurney

Sectional Boilers Heavy Duty Type of the 900 Series

Steam and Water

No. 949 STEAM BOILER
Also for Water

The largest size of the 900 Series is our No. 949 Steam Boiler (also for Water), the heavy duty type.

In spite of its size and capacity, this 72½-inch high boiler is easily erected, and where head room is limited it will meet every requirement. It may be noted from the illustration how compact the boiler is when installed.

The No. 949 type has a grate area of 21.84 sq. ft. as compared with 11.21 for No. 945, the smallest of the 940 series. With a rating of 6000 for steam and 9900 for water, this No. 949 type is well adapted for the large class of heavy duty work.

There is a Gurney Boiler for every requirement, and they can be relied upon for economy and satisfaction. They are made of the highest grade of pig iron, give long and continuous service, and embody many exclusive features.

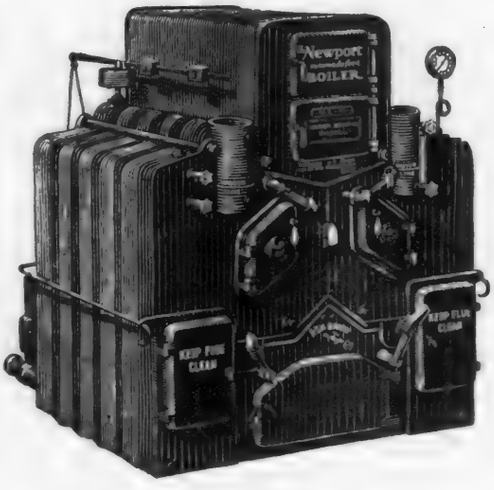
Send for Catalog

GURNEY HEATER M'F'G COMPANY.

General Offices:

New York 11 East 42d Street | Boston, Mass. 93-95 Oliver St., Fort Hill Square | Philadelphia 108 North 17th Street

ANNOUNCEMENT



Burns No. 1. Buckwheat to Stove Sizes of Coal.

During the many years of our business we have always held to an ideal of the highest standard of product at the lowest possible price.

That this policy has earned the confidence of those we have served is evident by the constant increase in volume of sales, with the result that a further reduction in price is possible at this time.

You may now furnish your clients with Newport Automatic Feed and Oil Burning Boilers at practically the same cost as ordinary boilers.

Our new plant with greatly increased production and improved manufacturing facilities, insures you the same high quality of product with better service and broader distribution.

Our engineering and sales departments are prepared to give you every cooperation.

Complete literature and prices upon request.

Newport Boiler Company

105 South Dearborn Street, Chicago, U.S.A.

New York Office: 101 Park Avenue

Wolff Draft Conditioners

Make it possible for any boiler to get more heat from its coal with less attention (*and we can prove it*)

By properly conditioning the chimney and draft to the boiler, Wolff Draft Conditioners make the boiler and chimney "fit" each other, and regulate the heat according to what is needed. They give any boiler *(even one operated by an unskilled man)* the same fine draft regulation usually obtained only by skilled engineers.

Hence: They help any boiler to provide a steady flow of steam, with the minimum amount of fuel and with a minimum amount of attention.

Library Plaza Hotel, Evanston, Ill. Heated with two Pacific Boilers, equipped with Wolff Draft Conditioners.

This is proved in more than 5200 Chicago buildings where Wolff Draft Conditioners are now installed.

There is good profit for every heating contractor in selling and installing them

Sales Representatives

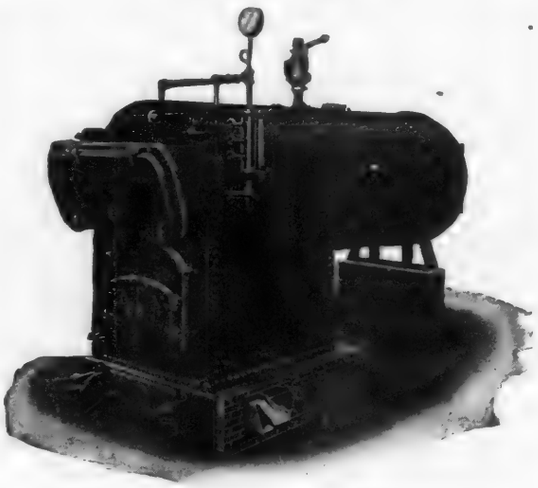
Calling on Architects Owners and Contractors

There are a number of choice cities still open for Sales Representation. Write us for particulars regarding our sales agency proposition.

Wolff Coal Saver Co.

1336 W. Congress St.
Chicago

AMES
Firebox Heating Boilers



Ames Firebox Heating Boiler with Plain Furnace

Built with Plain and Downdraft Furnaces. Incorporating the Latest and Most Advanced Ideas in Boiler Design and Construction.

We also build a complete line of Horizontal Tubular, Upright and Empire Boilers for Heating and Power Requirements.

Bulletins with complete details mailed on request.

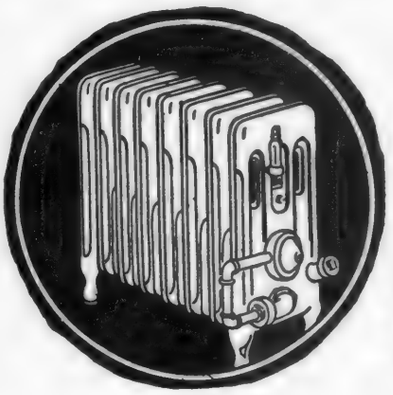
Empire Return Tubular Portable Boiler

AMES IRON WORKS
DIVISION OF
Pierce, Butler & Pierce Mfg. Corp.

Main Office & Works
Oswego, N. Y.

General Sales Office
41 E. 42nd St., New York City

There is no simpler solution of the heating problem



Designed for the complete heating of old or new buildings — offices, stores, factories, schools, public buildings, residences, and apartments

EACH RADIATOR AN INDEPENDENT STEAM HEATING PLANT

There is no heating system that is easier to install and use than Clow "Gasteam."

With Clow Gasteam Radiators you simply turn on the gas and light a match. You have a full head of steam inside of half an hour.

You need no water pipe connections. The water is contained in a chamber which you re-fill about every two weeks, if you are using the radiators constantly. There is no danger of bursting a radiator by freezing when not in use.

The water chamber is over a burner which emits a multitude of tiny Bunsen flames—clean, sootless heat which does not dry out but actually humidifies the air, keeping it healthful.

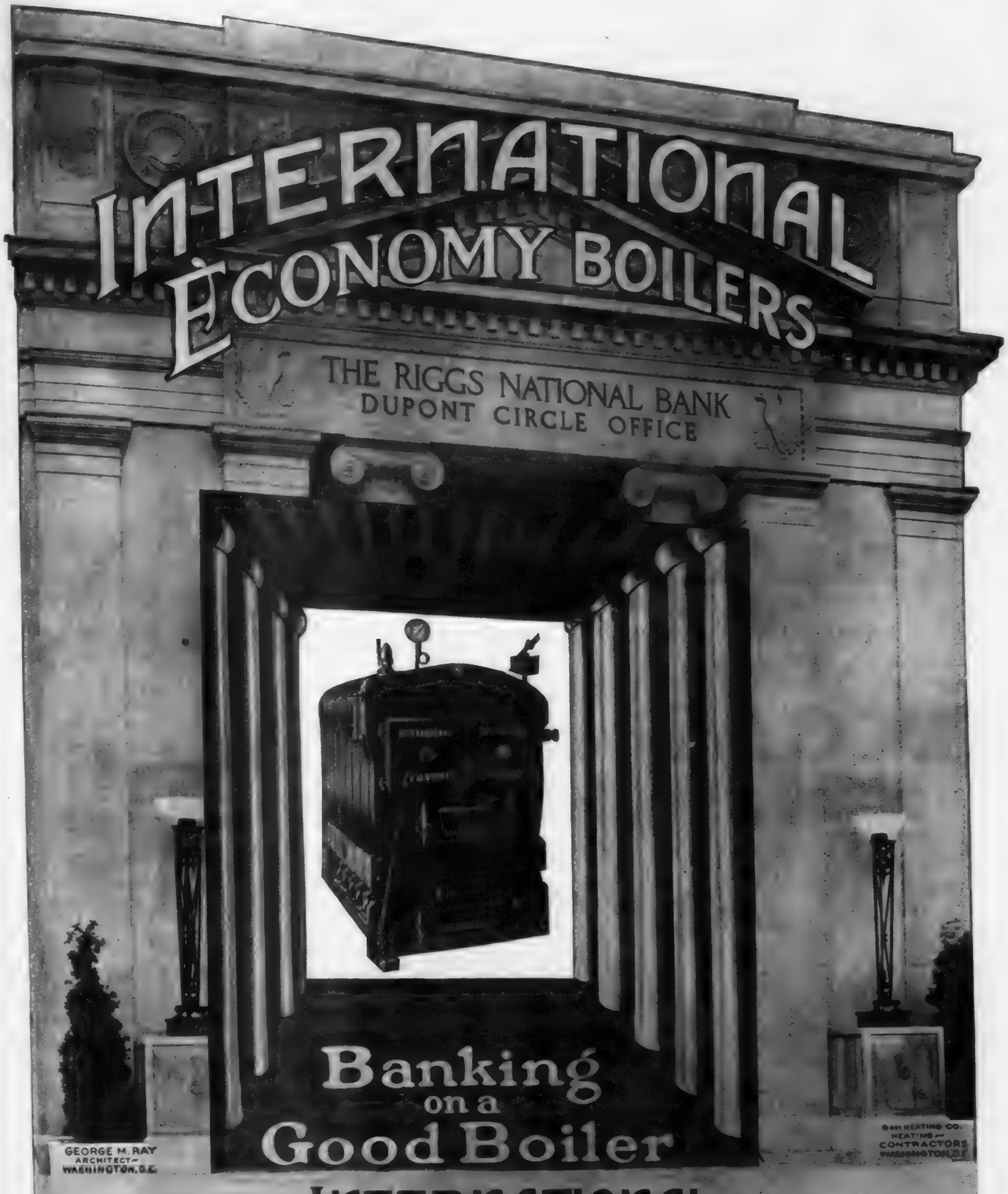
Each radiator is a separate heating unit. You can turn on as many or as few as you please.

Clow Gasteam is not merely "auxiliary" heating apparatus; it is designed to operate perfectly even when the gas supply is at its lowest pressure.

Inquire about Clow Gasteam before deciding on your heating equipment. Thousands of satisfied users everywhere.

JAMES B. CLOW & SONS
534-546 So. Franklin St.,
CHICAGO

CLOW "GASTEAM" HEATING SYSTEMS



an INTERNATIONAL *ECONOMY*

You can bank a nice margin of profit and a long list of satisfied customers by using Economy Boilers

INTERNATIONAL HEATER COMPANY

UTICA, NEW YORK

A Heating Plant Data Book for Architects

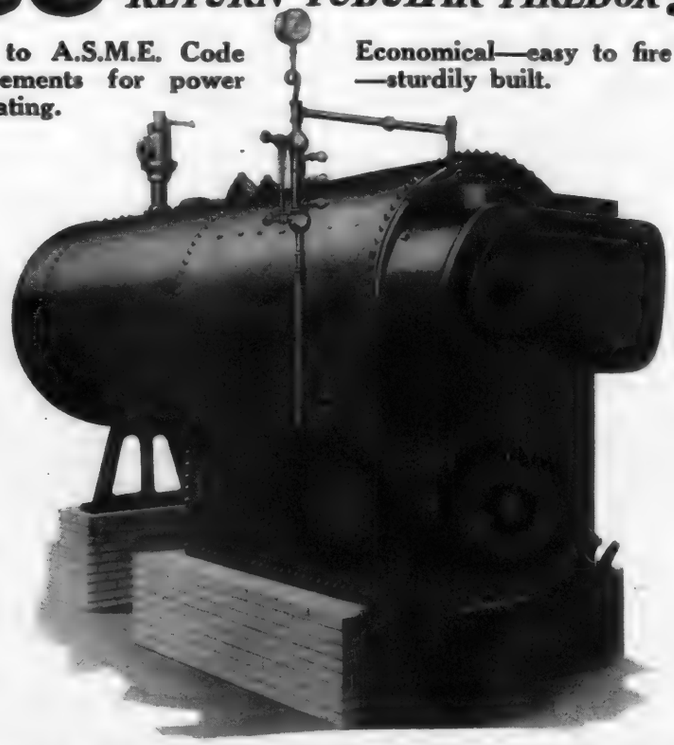
Titusville Catalog no. 85A

Every architect and engineer interested in power and heating boilers should have a copy of Titusville Bulletin No. 85A. It describes in detail all of the various types of Titusville Firebox Boilers and gives operating data that will prove of real value and interest.

TICO *RETURN TUBULAR FIREBOX* Boilers

Built to A.S.M.E. Code requirements for power or heating.

Economical—easy to fire —sturdily built.



THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PENNA.

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TITUSVILLE IRON WORKS CO.,
Titusville, Penna.
Send us one of your Catalogs No. 85-A
Company.....
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Title.....

Boiler Room of the new U.S. Chamber of Commerce Building at Washington, D.C. These three IDEAL 79″ Water Tube Boilers are connected with 13,250 feet of American Radiators (Peerless and Corto). The rest of the building is warmed by fan system connected with 2995 feet of Vento Heaters. Cass Gilbert, Architect; W. G. Cornell Co., Heating Contractor.

U. S. Chamber of Commerce selects low-pressure IDEAL Boilers

—*Three IDEAL 79″ Sectional Boilers warm their new headquarters at Washington, D.C.*

LOW-PRESSURE sectional boilers for heavy duty work in large buildings are rapidly coming into their own. The selection of IDEAL 79″ Boilers for this beautiful new addition to Washington's array of fine buildings, is but another evidence.

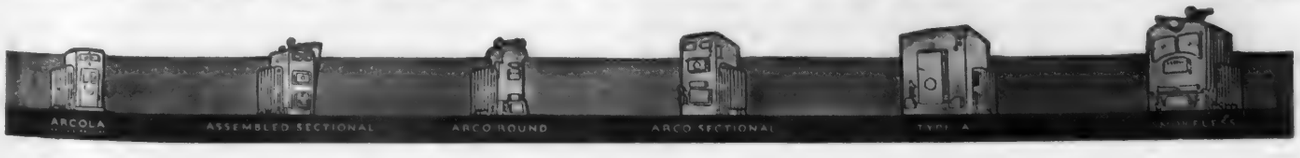
In single units, or in batteries, IDEAL Sectional or Smokeless Boilers are doing heavy duty work in large schools, churches, hospitals, banks, theatres, apartments, and office buildings, carrying radiation loads ranging from 1000 to 30,000 feet. They are now designed for this work in four sizes—29″, 36″, 48″ and 79″.

The many interesting points of construction of the new IDEAL Sectional and Smokeless Boilers have been described and illustrated in an attractive catalogue which every Heating Engineer should have. Simply send your name and address to the office below for your copy.

AMERICAN RADIATOR COMPANY

Dept. G 26, 1807 Elmwood Avenue, Buffalo, N.Y. *Sales Offices in all principal cities*

IDEAL BOILERS AND AMERICAN RADIATORS FOR EVERY HEATING NEED



Instant Hot Water

DALQUIST AQUATHERM COPPER RANGE BOILER

A Device That Has Long Been Needed

One of the most important developments in range boiler construction in many years is the DAHLQUIST AQUATHERM COPPER RANGE BOILER, which furnished to the consumer instant hot water at a minimum cost. It can be furnished in any size desired.

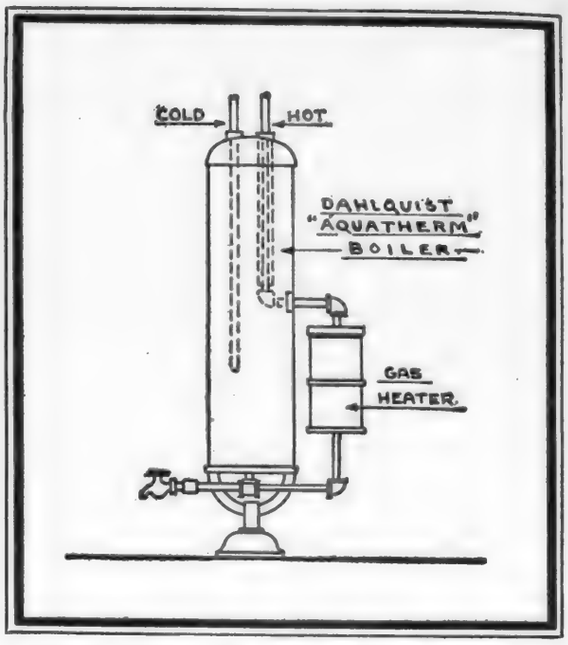
And the DAHLQUIST AQUATHERM can be furnished separately in proper size for any range boiler now installed.

Can be installed with any ordinary gas tank heater, water back in coal range, indirect heater, or coil in boiler or furnace, or electric heater.

Let us send full details.

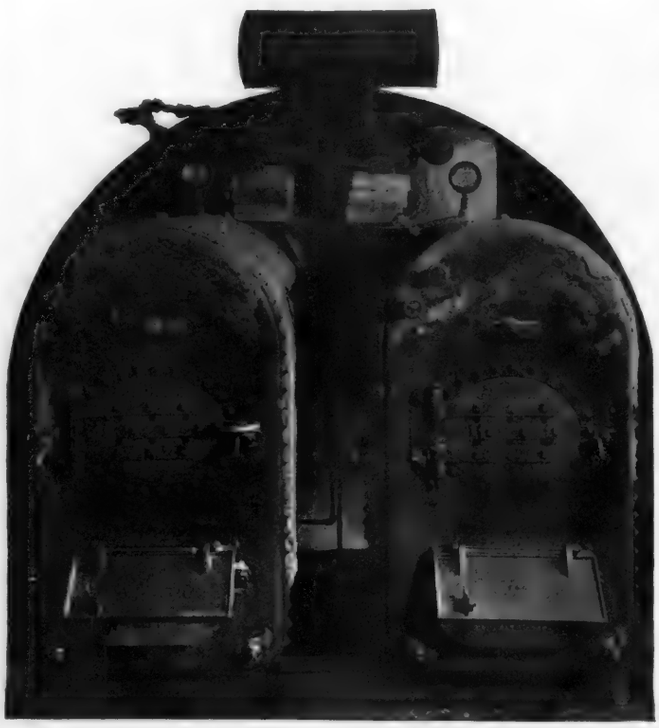
DAHLQUIST MFG. CO.

40 W. 3rd St. BOSTON, MASS.



Dahlquist Aquatherm Copper Range Boiler installed in connection with gas tank water heater in kitchen (note the simplicity and neat appearance of installation).

In Service Over 7 Years —and no repairs



When a Taylor Boiler Feed Trap can serve continuously on one job for seven years — without repairs — it certainly is a recommendation of the quality and workmanship that go to make up Taylor products.

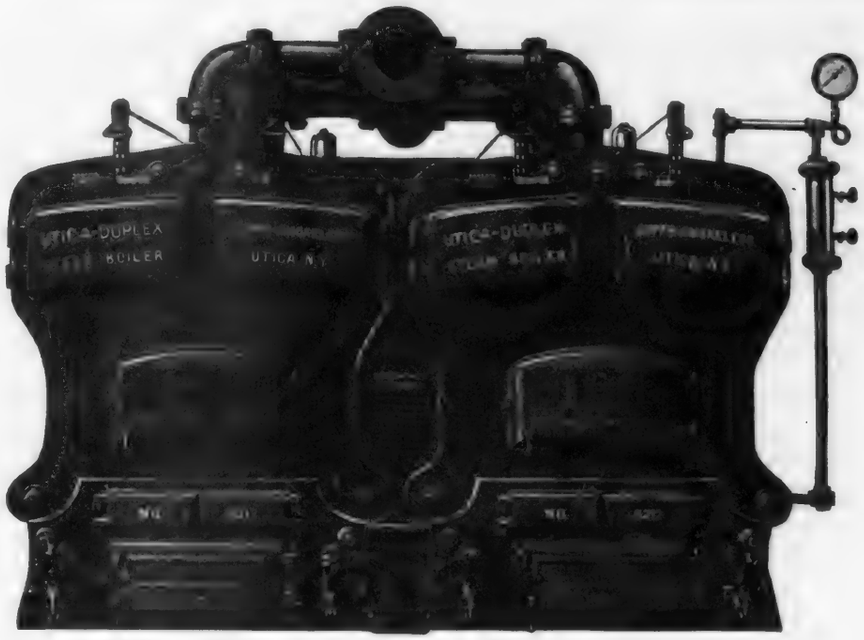
This Taylor Boiler Feed Trap, feeding two 25 H.P. fire box boilers in a woodworking plant, taking condensation from dry kiln and factory heating system, has justified the confidence of its owner by the economical and dependable service which it has rendered.

This good service is typical of all Taylor installations.

Let us send details in full.

TAYLOR MACHINE WORKS

85 S. Monroe St., Battle Creek, Mich., U. S. A.

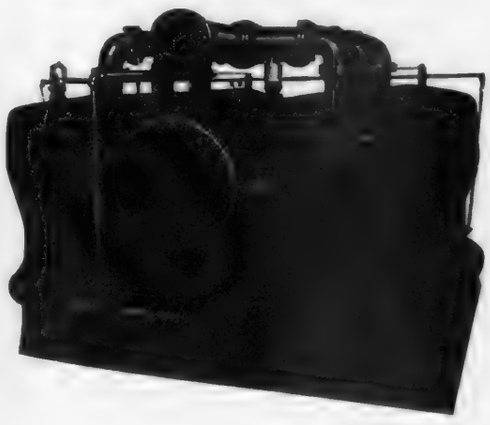


Front View of Utica-Duplex SUPER-SMOKELESS Boilers

UTICA-DUPLEX
SUPER-SMOKELESS BOILERS
Announcing the New Duplex Boiler!

UTICA-DUPLEX SUPER-SMOKELESS Boilers have many advantages over the ordinary type of wide grate boilers. A double fire-box gives a greater amount of heating surface per square foot of grate area, and this surface is in direct contact with the fire. The header construction, which is shipped as an integral part of the boiler, assures large steam space. The individual grates require less attention and make possible a greater latitude in the fire required at different seasons of the year. One half of the boiler will operate as efficiently as a single boiler, the other half neither chilling the fire nor requiring wastage of coal to cover the unused portion of the grate. It is possible to shut down one half of the boiler for cleaning the grates or any other purpose. Precautions have been taken to equalize the boilers, and a steady water line is maintained at all times. Engineers and contractors are invited to write for complete information.

Rear View of Utica-Duplex SUPER-SMOKELESS Boiler Showing Header, Equalizer, Return Connections and Air Grates through which Supplementary Air is admitted to the Boiler.



Manufactured by the

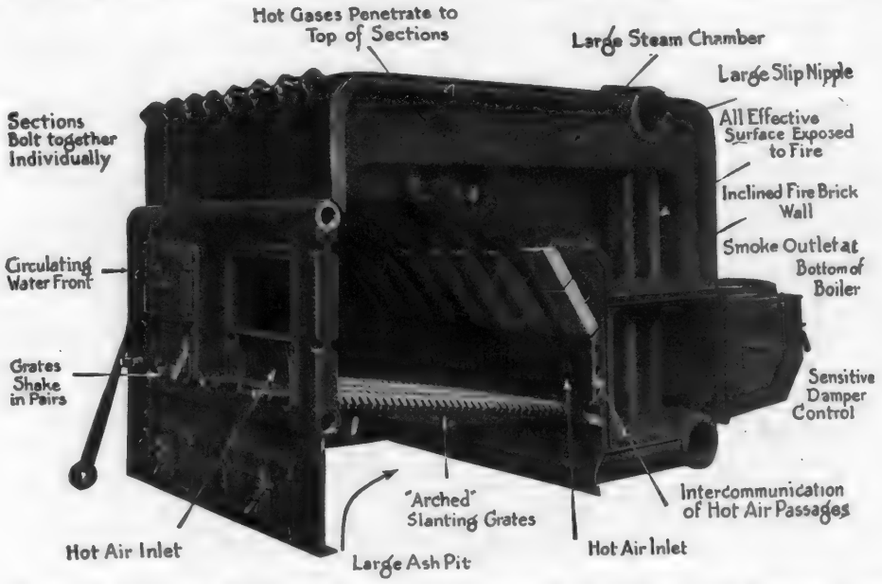
UTICA HEATER COMPANY

UTICA, N. Y.

CHICAGO CLEVELAND NEW YORK

Sales Offices in the Principal Centers

Ask Us Why It's Smokeless — Burns All Kinds of Fuel


Hot Gases Penetrate to Top of Sections
Large Steam Chamber
Large Slip Nipple
All Effective Surface Exposed to Fire
Inclined Fire Brick Wall
Smoke Outlet at Bottom of Boiler
Sensitive Damper Control
Intercommunication of Hot Air Passages
Hot Air Inlet
"Arched" Slanting Grates
Large Ash Pit
Hot Air Inlet
Sections Bolt together Individually
Circulating Water Front
Grates Shake in Pairs

Special inlets at front and back of grate supply HOT air in right amounts and in condition to burn gases, giving great efficiency and total absence of smoke, no matter what coal or oil you use. Just write your name and address, and "Catalog No. 23" on a card and mail it to us.

NIAGARA RADIATOR & BOILER COMPANY

General Office and Factory—North Tonawanda, N. Y. Branch Office and Factory—Chicago, Ill.

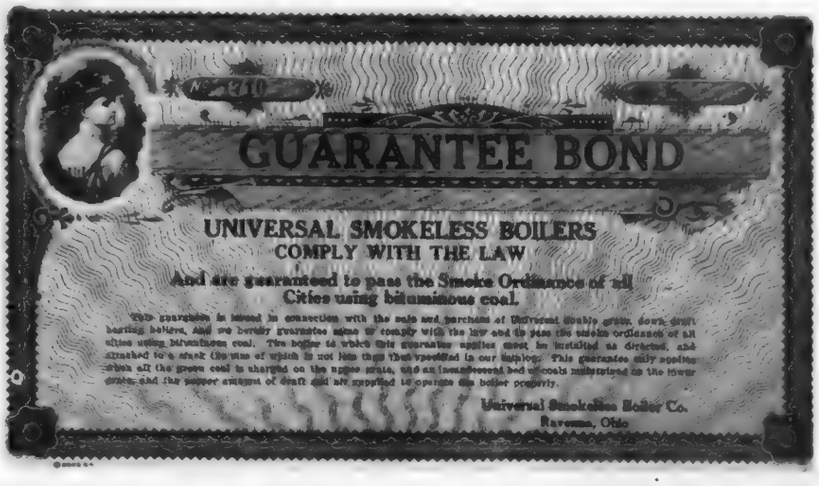
NIAGARA LOW WATER LINE SMOKELESS BOILERS

UNIVERSAL HEAT IS CLEAN HEAT

Universal Double-Grate, Down-Draft Smokeless Boilers

Comply with the Law

We give a bonded guarantee with each boiler that it will comply with the smoke ordinance of any city in the United States using bituminous high volatile Coal.


GUARANTEE BOND

UNIVERSAL SMOKELESS BOILERS
COMPLY WITH THE LAW

And are guaranteed to pass the Smoke Ordinance of all Cities using bituminous coal.

This guarantee is issued in connection with the sale and purchase of Universal double grate, down draft heating boilers, and we hereby guarantee same to comply with the law and to pass the smoke ordinance of all cities using bituminous coal. The boiler to which this guarantee applies must be installed as directed, and attached to a stack the size of which is not less than that specified in our catalog. This guarantee only applies when all the green coal is charged on the upper grate, and an incandescent bed of coals maintained on the lower grate, and the proper amount of draft and air supplied to operate the boiler properly.

Universal Smokeless Boiler Co.
Ravenna, Ohio

UNIVERSAL SMOKELESS BOILER CO.

FACTORY and MAIN OFFICE, RAVENNA, O.

PAGE BOILERS

"The Distinguished Service Line"

Monarch
Smokeless Boiler
(Cutaway View)

raise a pressure in a very few minutes and carry the load steadily with a slow even fire.

Large firebox, with ample coal carrying capacity, and long sensitive, three-way fire travel—these give quick response and consistent heating satisfaction, with the maximum of fuel economy.

There is a Page Boiler for every requirement—Volunteer Round and Monach Square Sectional.

For All Fuels—
Hard Coal,
Soft Coal,
Gas or Oil.

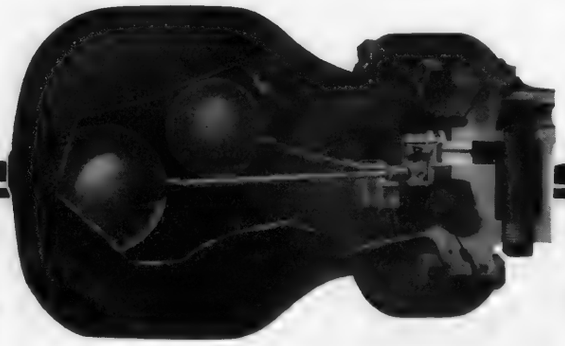
A request on your letterhead will bring you catalog of all our boilers.

THE WM. H. PAGE BOILER CO.

58 West 40th Street
NEW YORK

BOSTON
PHILADELPHIA
Established 1856

CLEVELAND
MEADVILLE
Incorporated 1877



THE LAST WORD IN BOILER PROTECTION

To maintain proper water line in heating boilers is to eliminate most of the trouble in their operation.

McDonnell & Miller Duplex Water Feeders are *real* protection to low pressure steam boilers from the dangers of low water. They prevent cracked sections and burned boilers.

They also take care of excess condensation, and so prevent flooding the boiler.

They eliminate the worry over "water line" and remove the human element from boiler operation by making the manual control of the water supply unnecessary.

They are particularly necessary on oil fired boilers where great damage can be done quickly if the oil burner comes on with insufficient water in the boiler.

WRITE FOR BULLETIN S-1

Mc DONNELL & MILLER

CONWAY BUILDING — WATER FEEDER — CHICAGO ILLINOIS

"DOING ONE THING WELL"

Bank Buildings

PERHAPS you are figuring on the hot water needs of a bank building.

Just as samples of our experience in this special field we list a dozen banks in which Whitlock Heaters furnish an ample supply of hot water.

American Industrial Bank	Hartford, Conn.
Bank of Montreal	New York, N. Y.
Citizens National Bank	Battle Creek, Mich.
Chicago Trust Co.	Chicago, Ill.
Commercial National Bank	Peoria, Ill.
Dime Savings Bank	Toledo, Ohio
Fletcher Savings & Trust	Indianapolis, Ind.
Harvard Trust Co.	Cambridge, Mass.
Quebec Bank	Winnipeg, Man
Safe Deposit & Trust Co.	Baltimore, Md.
Security National Bank	Sioux Falls, S. D.
Waterbury National Bank	Waterbury, Conn.

Estimates on your bank problems—or other problems—will be cheerfully given.

THE WHITLOCK COIL PIPE CO.

40 South Street, Hartford, Conn.

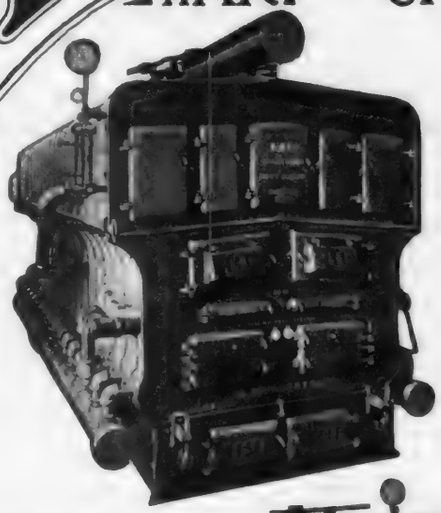
New York Chicago Boston Buffalo Philadelphia San Francisco

WHITLOCK HEAT TRANSFER PRODUCTS

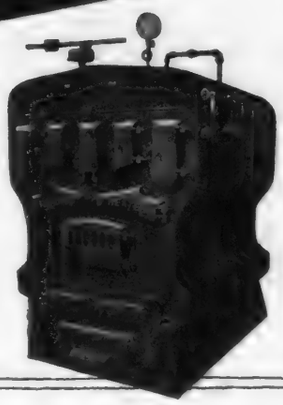
ROYAL

ROUND SECTIONAL and SMOKELESS BOILERS

HART AND CROUSE



Sectional Boilers, Steam and Water, including Smokeless, 800 sq. ft. to 32,600 sq. ft. steam capacity



Round Boilers, Steam and Water, 425 sq. ft. to 1600 sq. ft. steam capacity.

The ROYAL FAMILY

TWO Hundred and Fourteen ROYAL Round, Sectional and Smokeless Boilers, Steam and Water, ranging from 425 sq. ft. to 32,600 sq. ft. steam capacity, comprise the ROYAL FAMILY.

The ROYAL Hart & Crouse Downdraft Smokeless Water Tube Boiler was the first Cast Iron Downdraft Boiler and since 1907 has provided smokless combustion *independent of firing skill.*

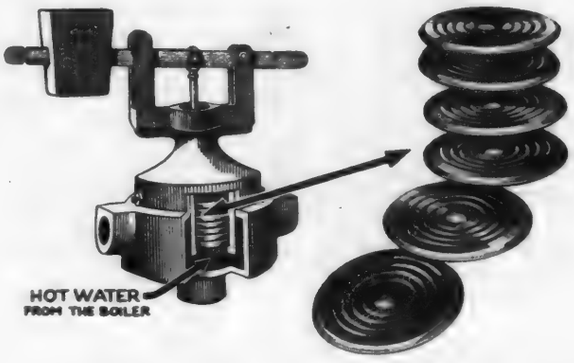
Cosy Cottage
or
Soaring Skyscraper

HART & CROUSE COMPANY

UTICA, N. Y.

BRANCH OFFICES

Boston	Detroit	Philadelphia
Chicago	Grand Rapids	Pittsburgh
Cincinnati	Milwaukee	St. Louis
Cleveland	New York	Utica



6 Reasons why Thrush REGULATION is More Efficient!

1. Thrush System comprises equipment to be added to the ordinary unregulated gravity job which makes it a controlled and self-regulated system.
2. Thrush Regulation provides the greatest fuel economy, efficient heating, with a minimum of attention.
3. The Thrush Regulator itself is an important and highly efficient part of Thrush System. It provides uniform control of dampers.
4. The thermostat consists of six independent units working together.
5. A defect in one or more units does not prevent continued operation of the Regulator.
6. Thrush Regulator can be placed in any position above dampers to provide greatest leverage and most efficient operation.

Write for Catalog

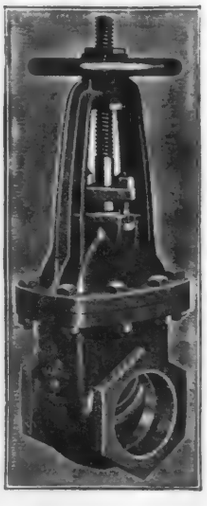
H. A. Thrush & Co. PERU, IND.

IRON BODY GATE VALVES

SCREWED, FLANGED
AND
HUB END STYLES

NON-RISING STEM
AND
O. S. and Y. PATTERNS

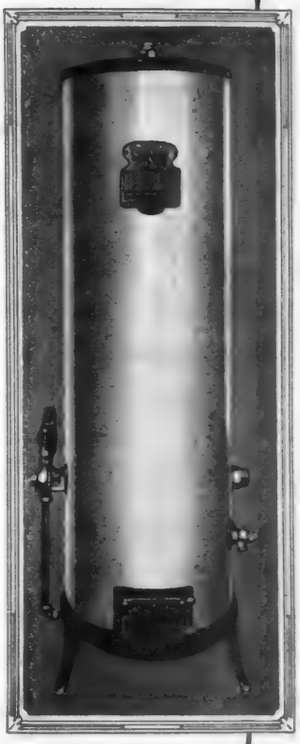
ALSO MANUFACTURERS OF
Cast and Malleable Iron Fittings



Illinois Malleable Iron Company

1801 Diversey Parkway Chicago, Ill.

These twenty plumbers sold 758 EverHot Heaters in 1924



1—Harroun Plumbing & Heating Co., Detroit, Michigan

2—Will Peters, Baltimore, Md.

3—James F. Hallinan, Philadelphia, Pa.

4—Kaufman & Parker, Detroit, Michigan

5—J. H. Schulke, Philadelphia, Pa.

6—J. M. Kalish, Chicago, Illinois

7—Charles T. King, Baltimore, Md.

8—G. Weber, Philadelphia, Pa.

9—Cunningham Heating & Plumbing Co., Detroit, Michigan

10—S. T. Damitio, Detroit, Michigan

11—W. Fred Grosscup, Baltimore, Md.

12—C. W. Jones, Chicago, Illinois

13—Fred Flader, Evanston, Illinois

14—David J. Baker, Detroit, Michigan

15—Charles Schaffer, Baltimore, Md.

16—Wm. M. Anderson, Philadelphia, Pa.

17—J. Bert Lentz, Philadelphia, Pa.

18—A. P. Spires, Chicago, Illinois

19—Chester L. Tuck, Detroit, Michigan

20—E. C. Oakes, Chicago, Illinois

An Average of 37 EverHots for Each Plumbing and Heating Contractor on the List

Figure it for yourself—wouldn't the profit on thirty-seven EverHot Heaters be quite a nice addition to your income? And it is a net profit, too. Our distributing organization now covers practically the entire United States and assumes the full responsibility for the service and attention that may be necessary to make every owner a booster.

The EverHot Heater has none of the disadvantages of the old types—no reduction of water pressure—no liming troubles—no condensation—no burner troubles—practically free from the necessity for service—economical in operation—modest in price. That's the heater that builds good will for the plumbing and heating contractor who installs it.

EverHot Heater Company

5215 Wesson Ave. Detroit, Mich.

Are salesmen a bore?

The Branches You Located

EASTERN DEPARTMENT

Boston	Massachusetts
New Haven	Connecticut
Binghamton	New York
Long Island City	New York
New York City	New York
Newark	New Jersey
Philadelphia	Pennsylvania
Baltimore	Maryland
Charlotte	North Carolina
Atlanta	Georgia
Birmingham	Alabama
Pittsburgh	Pennsylvania
Buffalo	New York

CENTRAL DEPARTMENT

Chicago	Illinois
Detroit	Michigan
Cleveland	Ohio
Cincinnati	Ohio
Parkersburg	West Virginia
Indianapolis	Indiana
St. Louis	Missouri
Memphis	Tennessee
New Orleans	Louisiana
Houston	Texas
Tulsa	Oklahoma
Kansas City	Missouri
Omaha	Nebraska
Milwaukee	Wisconsin
Minneapolis	Minnesota
Denver	Colorado

WESTERN DEPARTMENT

San Francisco	California
Seattle	Washington
Portland	Oregon
Salt Lake City	Utah
Los Angeles	California
Phoenix	Arizona

"ALL SALESMEN bother us more or less," said an Indiana engineer, "but some concerns do not perpetrate salesmen of the *boresome* sort. They are often helpful in making clear some obscure matter. Their companies would probably sell exactly as much goods if they did not help us, but the goods would not give as much satisfaction, for the simple consideration that we should not be able to make the best use of what we do use."

Oxweld Salesmen are neither order takers nor peddlers. Nor are they of the boresome sort. They are technical advisers and helpers, and their chief mission is to see that you get the greatest possible use out of your Oxweld apparatus.

Every Oxweld representative will tell you honestly whether you can use Oxweld apparatus profitably or not. Every one can help you extend the usefulness of our apparatus after you purchase it. Half of these field representatives have been with Oxweld for five years or more and can bring valuable experience to you.

OXWELD ACETYLENE COMPANY

Chicago, 3642 Jasper Place — Long Island City, N.Y., Thompson Ave. & Orton St. — San Francisco, 1050 Mission Street

Oxweld

WELDING AND CUTTING APPARATUS

WORLD'S LARGEST MANUFACTURERS OF WELDING AND CUTTING EQUIPMENT

Continental

BOILERS AND RADIATORS

Every Architect, Heating Engineer and Contractor should have this Continental book. It tells the story of Continental Boilers and Radiators. Write for your copy now.

How easy firing adds to Continental Low Water Line Economy

CONTINENTAL Low Water Line Boilers are fired the short way of the grate.

The grate bars operate in series of twos and threes. This makes it easy to fire or shake any portion of the grate surface without disturbing the balance of the fire or shaking live, unburned coals into the ash pit.

With Continental side feed an even fire, always recognized as the most efficient, is easily maintained on the entire grate surface.

Continental Low Water Line Boilers are quick steamers. They hold a steady water line. They burn any kind of fuel, including oil.

Made in regular and smokeless types.

Built for better heating

30 Series Boilers 43 inch Water Line
1200 to 8200 sq. ft. steam capacity

40 Series Boilers 47 inch Water Line
2500 to 22,300 sq. ft. steam capacity

Continental Heater Corporation
Home Office and Factory
Dunkirk, N. Y. U.S.A.

Performance Counts Most!

JUDGED by records of performance in competitive tests, the Thatcher Round Boiler has proved its superiority. Under actual identical working conditions it transmitted a greater number of Thermal Heating units to the water, and showed perfect efficiency between long firing periods. Thatcher Boiler ratings are **conservative** Send for the eighty-page Thatcher Boiler catalog. Just write your name on your letterhead and you will receive full details by return mail.

THE THATCHER COMPANY

Formerly Thatcher Furnace Co.
Since 1850

133-135 W. 35th St., New York, N. Y.
39-41 St. Francis St., Newark, N. J.
341 N. Clark St., Chicago, Ill.

THATCHER
BOILERS-FURNACES-RANGES

In the Twin Cities

The Pipe Basis for Modern Building

MINNEAPOLIS and St. Paul are proud of their distinction as "The Gateway of the Northwest." In these Twin Cities one can see everywhere that spirit of the pioneer who blazed trails and set up landmarks which have lived to justify the vision of the builder as well as the substantial materials put into them. The larger modern buildings have added much to this substantial beginning and reflect credit upon the architects and engineers who caught the vision and builded well. Naturally, dependable materials were needed to safeguard the future — and "NATIONAL" Pipe was generously used.

The buildings illustrated are taken from Bulletin No. 25—"NATIONAL" Pipe in Large Buildings. This publication contains useful data on pipe for building purposes. A copy will be sent upon request.

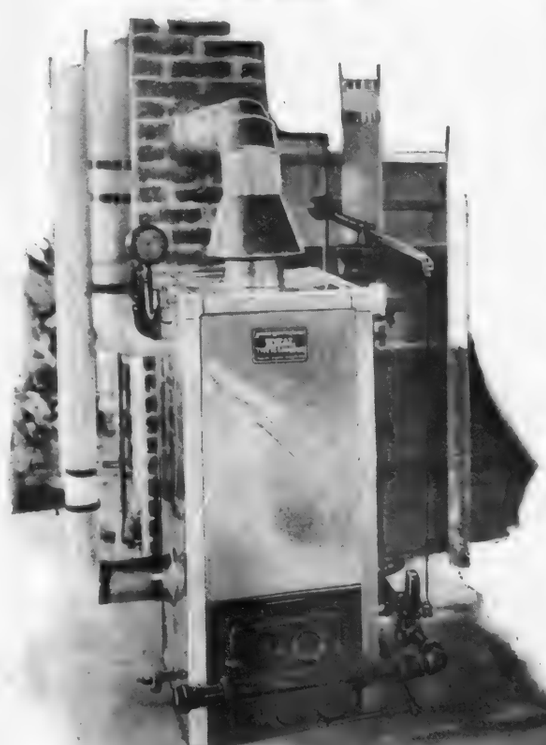
NATIONAL TUBE COMPANY, PITTSBURGH, PA.

DISTRICT SALES OFFICES IN THE LARGER CITIES

10 minutes' firing a year

attracts owners of small homes, too

All IDEAL Gas Boilers are tested and rated on AGA Code; therefore in comparing capacities you need add only 25% to total condensing load (including piping). Efficiency attained exceeds 85%.



THE IDEAL Gas Boiler meets with as cordial welcome in smaller homes of the better class as in larger homes, many Gas Companies find. The factor that makes a prospect is the desire for gas convenience and comfort—not the size of the house or of the bank balance. The small home is the big market.

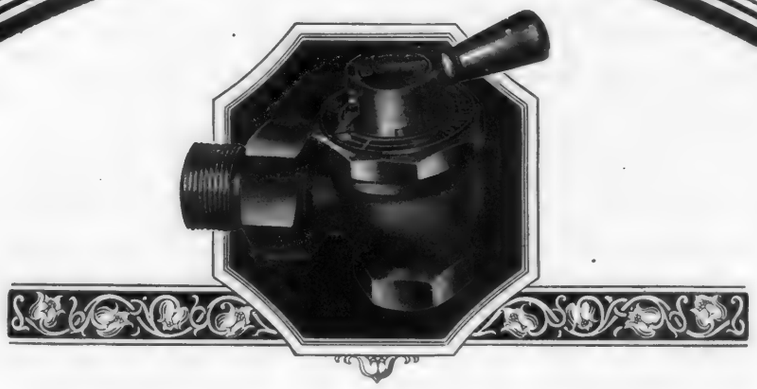
The 1-G-4 IDEAL Gas Boiler, illustrated, efficiently keeps Mr. Tedford's house at summer temperature the year round with less than 15 minutes' attention a year. He gets skilled, systematic service from his local Gas Company. His home stays immaculately clean because no dirty coal or ashes are handled. His fuel is paid for monthly *after* he has used it, not in advance for a whole season's supply. Fuel is drawn from the mains only as temperature demands.

Learn more about this new product of American Radiator Company's great Research Laboratories. Study the AGA Code ratings, the comparative operating costs, and our interesting selling plan.

The A.H.Wolff Gas Radiator Co.

Distributors American Radiator Company's IDEAL Gas Boilers

376 Lafayette Street, Dept. G-26
New York, N.Y.



FLEXIBILITY

An attribute of Dunham Heating that is as vital as it is characteristic

DUNHAM *flexibility* is no mere catch-phrase of sales propaganda. It is a vital, demonstrable attribute of Dunham Heating which the system possesses as one of its inherent advantages.

Dunham Steam Heat can be closely regulated. It is under the control of the owner at the turn of an inlet valve. If a room is too warm, as in mild weather may be the case, the temperature can be reduced to the degree needed for perfect comfort. If more heat is required, it will be found ready and waiting when the valve is opened. Any desired room temperature may likewise be steadily maintained.

We might devote this entire advertisement to an explanation of the merits of the Dunham Inlet Valve—a truly packless valve which contains no springs or gaskets, *and which cannot leak*—for it is this valve which brings Dunham Heating under such close control.

Steam circulates freely and noiselessly in the Dunham System, at close to atmospheric pressure. Dunham Thermostatic Radiator Traps make possible to every Dunham owner this important requirement of effective home heating comfort.

Flexibility is but one of *six* great advantages possessed by the Dunham System. Our later advertisements will tell you about the other five.

Over sixty branch and local sales offices in the United States and Canada bring Dunham Heating Service as close to your office as your telephone. Consult your telephone directory for the address of our office in your city.

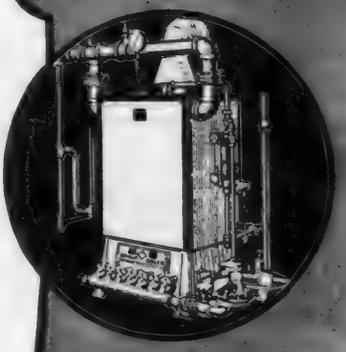
C. A. DUNHAM CO., 230 East Ohio Street, Chicago.

The DUNHAM REG. TRADE MARK HEATING SERVICE

Here's a Whole Street of Gas Heated Homes!

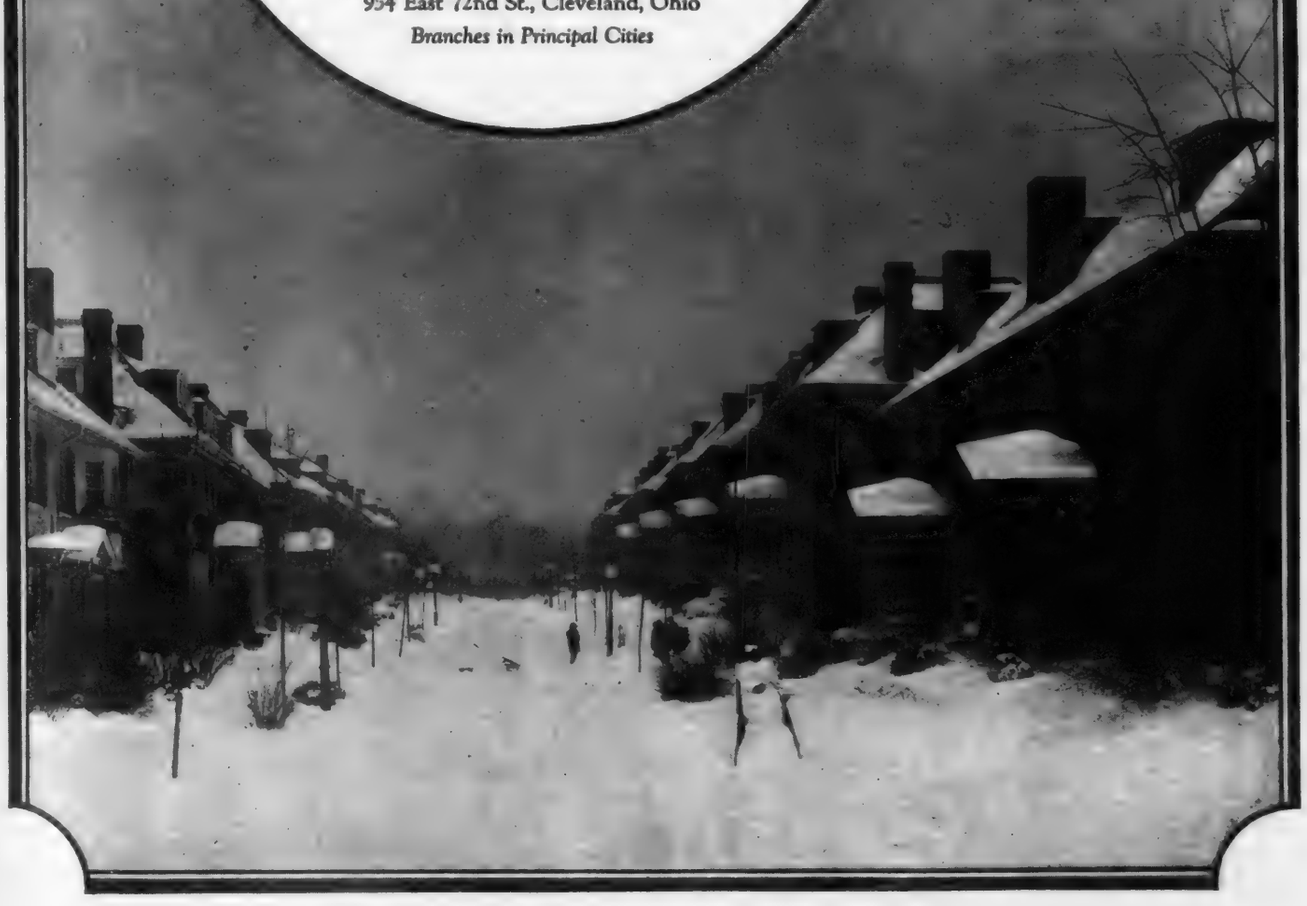
Zero weather and not a wisp of smoke from a single chimney on this Baltimore street! The cleanness of the snow is almost startling.

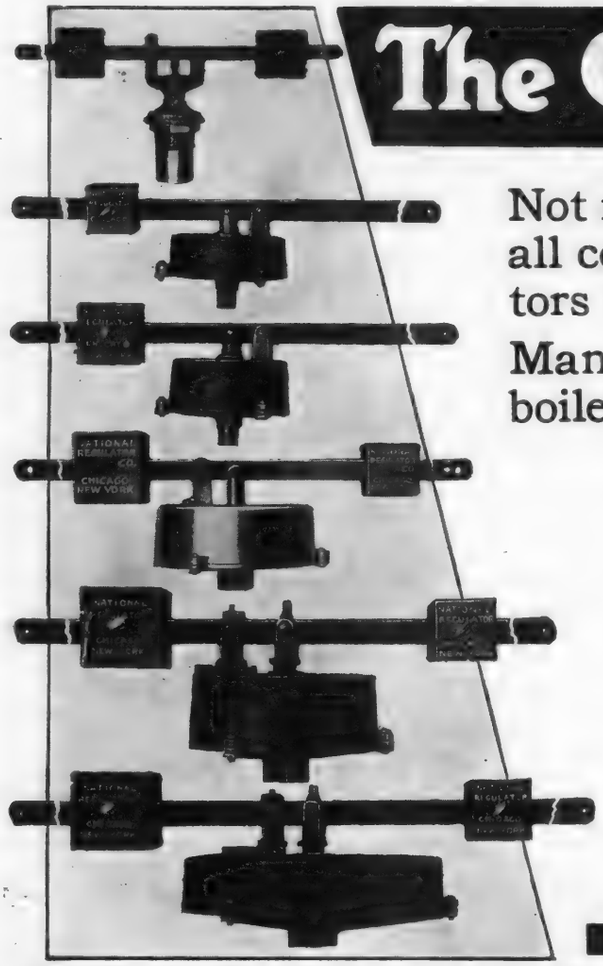
More and more heating engineers are realizing that gas is nationally known, nationally recognized and nationally accepted as the ideal fuel for heating the home.



BRYANT HEATING
for **Hot Water** **Steam** *or* **Vapor**

THE BRYANT HEATER & MANUFACTURING COMPANY
954 East 72nd St., Cleveland, Ohio
Branches in Principal Cities





The Complete Line

Not merely one regulator to cover all conditions but a line of regulators to meet every requirement.

Manufacturers of the better boilers have standardized on

METAPHRAM DAMPER REGULATORS

Metal Diaphrams—Last the life of the boiler

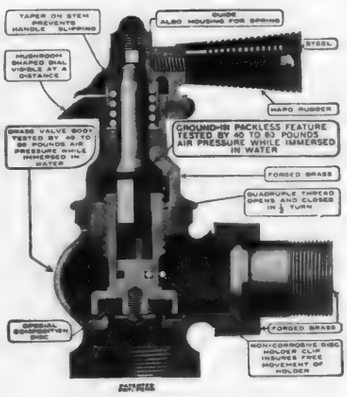
For Low Pressure Steam—Vacuum—Vapor or Hot Water. Smallest to the largest Boilers.

Write for catalog—if your jobber cannot supply

NATIONAL REGULATOR CO.
2301 KNOX AVENUE CHICAGO
The A Jacks People (A Jacks for High Pressure)

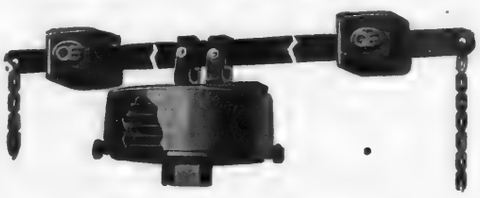
METAPHRAM

THE O-E 3 IN 1 HEATING SPECIALTIES

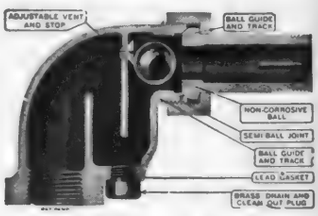

TAPER ON STEM PREVENTS HANDLE SLIPPING
GUIDE ALSO HOUSING FOR SPRING
MUSHROOM SHAPED DIAL VISIBLE AT A DISTANCE
STEEL
HARD RUBBER
GROUND-IN PACKLESS FEATURE TESTED BY 40 TO 80 POUNDS AIR PRESSURE WHILE IMMERSED IN WATER
BRASS VALVE BODY TESTED BY 40 TO 80 POUNDS AIR PRESSURE WHILE IMMERSED IN WATER
FORGED BRASS
QUADRUPLE THREAD OPENS AND CLOSES IN ¼ TURN
SPECIAL COMPOSITION DISC
FORGED BRASS
NON-CORROSIVE DISC HOLDER CLIP INSURES FREE MOVEMENT OF HOLDER

"O-E" Improved Perfect Packless Graduated Valve.

MERIT INVESTIGATION

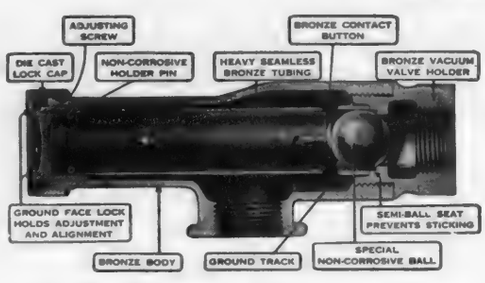


No. 2 "O-E" (3 IN 1) Regulator



"O-E" Perfect Ball-Check Water Seal Union Elbow with Adjustable Air Vent.

TRADE O-E MARK



"O-E" Improved Air Exhauster and Vacuum Valve

Three Systems in One

VAPOR, part of the time.	VACUUM most of the time.	PRESSURE, when wanted.

The simplest and most flexible heating system of any.

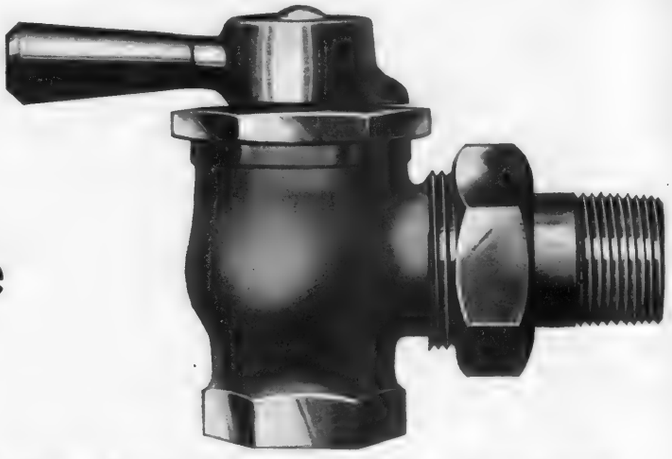
In addition to results of many tests showing the high efficiency of O-E Products, we have many letters from owners, architects and builders telling us that the O-E System of Heating is responsive, economical and efficient in every way.

Let us send you some interesting data on recent tests.

O-E SPECIALTY MFG. CO.
12 KEEFE AVENUE MILWAUKEE, WIS.

OVER 1,000
GORTON
Quarter Turn
PACKING LOCK
VALVES
used on the Hot Water Heating System under pressure (forced circulation)
Of the 14 Buildings, eight are six stories high
Hudson View Gardens
182nd to 186th Streets, Pinehurst and Northern Avenues New York
Tenant Owned Apartments
ATERNO CONSTRUCTION COMPANY, Builder
GEORGE FRED PELHAM, Inc., Architect
GEORGE F. MUSSELMAN, Consulting Engineer
WOOD, DOLSON COMPANY, INC., Agents
J. L. MURPHY Inc., Heating Contractor
GORTON & LIDGERWOOD COMPANY
96 Liberty Street, New York

THE
W.D. CASHIN CO.
THERMOFLEX



Lever Handle Inlet Valve

Another Quality Product for Quality Work. The Architect, Engineer and Contractor who wants the best should investigate and send for catalogs and prices. Made in all sizes and with wheel handle or lock shield if desired. Our line is complete.

You need our complete bulletin catalog

MANUFACTURED BY

W. D. CASHIN COMPANY

35 HARTFORD STREET BOSTON, MASS.

The Mouat System of Heating Operates on 1 to 2 oz. Pressure

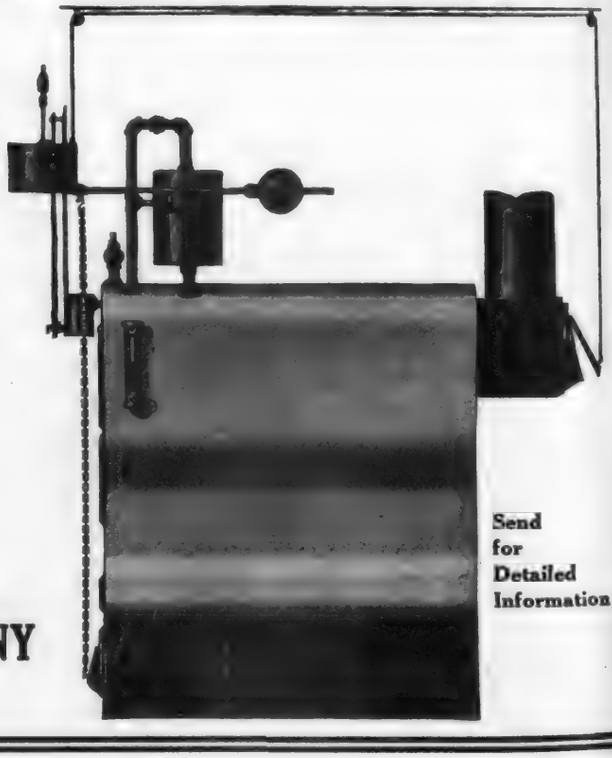
How Pressure is Maintained

The Mouat System of Heating, a two-pipe gravity vapor or atmospheric steam heating system, operates at from 1 to 2 ounces pressure. No pumps, thermostatic valves, return traps or mechanically operated parts.

This extremely low pressure is maintained by the Mouat Damper Regulator, sufficiently sensitive to operate at a variation of less than one ounce. This regulator is not affected by high, low, or unsteady waterline, since the working parts are connected above the waterline of the boiler. No water can be forced out of the boiler through the regulator.

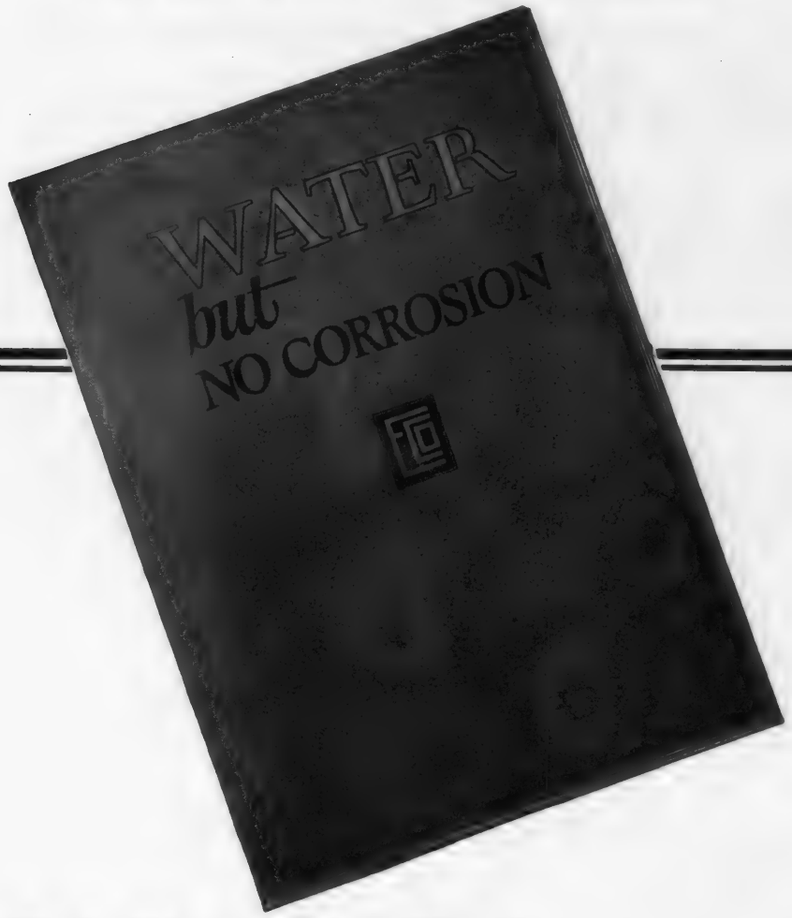
This regulator can also be used to reduce steam pressure to vapor pressure on central station heating plants.

The accompanying illustration shows a typical installation of a Mouat Damper Regulator.



Send for Detailed Information

MOUAT VAPOR HEATING COMPANY
CLEVELAND, OHIO



Let's Get Down to Facts Regarding Corrosion of Pipe

Are you interested in the reason why hot water pipes corrode? Do you know that any kind of pipe material is damaged sooner or later by corrosion caused by dissolved oxygen in the water? Are you acquainted with de-oxygenating apparatus which removes from the water the dissolved gases which cause corrosion?

The Bulletin, above, is just off the press. It discusses corrosion in hot water pipes, giving facts and figures, all in understandable terms. It describes the simple apparatus which will put a stop to corrosion. A copy is yours on request.

ELLIOTT COMPANY

Pittsburgh, Pa.

General Offices: Jeannette, Pa.

District Sales and Service Offices: Atlanta, Baltimore, Boston, Chicago, Cincinnati, Cleveland, Detroit, Kansas City, Philadelphia, Pittsburgh, New York and St. Louis.

ELLIOTT
De-oxygen-ating Apparatus

Elliott Co., Jeannette, Pa.
Please send me a copy of your Bulletin N-5 entitled "Water—But No Corrosion."

..... Name

..... Company

..... Address

N-831

FORGED BRASS a Hard Nut to Crack

EVERY steamfitter is familiar with the abuse the tail-nut of a radiator valve must withstand, and knows from experience the trouble a broken nut may cause.

Commonwealth - Lavigne Radiator Valves are equipped with a forged nut—twice as strong as the ordinary casting—which will not crack nor break.

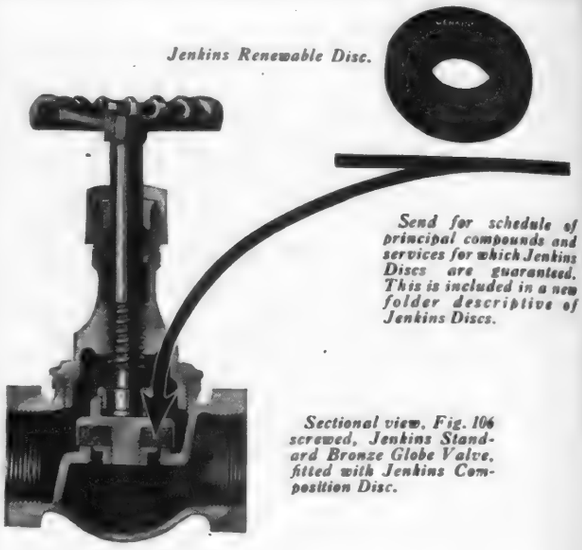
Commonwealth - Lavigne Radiator Valves spell satisfaction to all concerned; try them out on your next installation.

Your jobber can supply you.

COMMONWEALTH BRASS CORPORATION
DETROIT

LAVIGNE COMMONWEALTH
RADIATOR VALVES

Jenkins Renewable Disc.



Send for schedule of principal compounds and services for which Jenkins Discs are guaranteed. This is included in a new folder descriptive of Jenkins Discs.

Sectional view, Fig. 106 screwed, Jenkins Standard Bronze Globe Valve, fitted with Jenkins Composition Disc.

There's a Jenkins disc for every service

Plumbing and heating contractors can assure their customers of the best results by standardizing on Jenkins discs whenever renewals are necessary.

There is a Jenkins renewable disc for every service—cold water, hot water, steam and other fluids and vapors. And the right Jenkins disc in a Jenkins valve is the combination for perfection of performance.

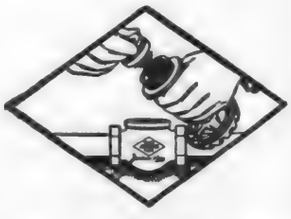
Jenkins composition discs are manufactured from high-grade rubber and carefully selected ingredients. Jenkins metal discs, in exactly the same dimensions as the regular Jenkins discs are supplied for special service for which rubber composition discs are not suitable.

JENKINS BROS.

80 White Street.....New York, N. Y.
524 Atlantic Avenue.....Boston, Mass.
133 No. Seventh Street.....Philadelphia, Pa.
646 Washington Boulevard.....Chicago, Ill.

JENKINS BROS., Limited
Montreal, Canada. London, England

Discs are quickly and easily renewed without removing valve from the line.



Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

An Adsco underground steam line furnishes steam to the Library of the Beechnut Packing Co. Insert shows cross section of steam line.

Under the Snow-Covered Ground

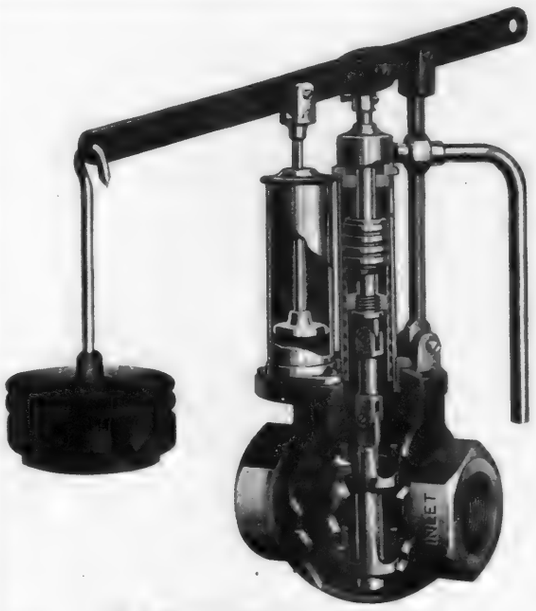
BUT not melting the snow—is an Adsco Underground Steam Main that runs parallel to the building, four feet away from the wall, and carries steam to heat the building you see in the distance. This steam main was designed by Adsco engineers and is insulated by means of Adsco Standard Steam Pipe Casing. The insert shows the cross section of the main showing the steam pipe, the casing and the method of drainage.

If you are interested in conducting steam from one building to another make use of the experience of our engineers. Ask for Bulletin No. 20-H-I.

AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS
NORTH TONAWANDA, N.Y.
Offices:
NEW YORK CHICAGO SEATTLE

ADSCO HEATING



No. 1 Pressure Regulator—Piston Type
Made in sizes ¾ to 14 in. inclusive—Std. and Ex. Hvy.
Sizes 1½ in. and under made with bronze bodies—screwed ends only.
Sizes 2 to 6 in. inclusive made with iron bodies—screwed or flanged ends.
Sizes 7 in. and above made with iron bodies—flanged ends only.

KLIPFEL
PRESSURE REGULATORS

Automatically reduce any initial steam, air or water pressure to any desired reduced pressure above 2 lbs.

Maintain reduced pressure constantly regardless of fluctuations in boiler pressure, or changes in the demand for steam.

Simple, rugged and direct acting. As low pressure builds-up and exerts pressure under piston, a balance is formed between low pressure and weighting, which in turn regulates the inner valve opening.

Visible in action. Lever may be used to open, close or test by hand. Position of inner valve may be easily judged by looking at the lever.

Bronze cylinder, multiple grooved piston and balanced plunger type bronze inner valve. All working parts removable while valve body remains in the pipe line.

No troublesome springs, toggles, packing boxes or pilot valves. Dashpot included, which insures steady service pressure and overcomes any tendency of valve to chatter or vibrate.

Guaranteed to closely regulate at maximum steam loads, as the capacity—size for size—is equal to or greater than that of any competing pressure regulator.

We Invite Correspondence.

KLIPFEL MFG. CO., 2641-59 W. Harrison St. CHICAGO, ILL.

Manufacturers of a Complete Line of Steam Specialties including Expanded Outlet Pressure Regulators (Both Piston and Diaphragm Types)—Float Valves—Pump Governors—Back Pressure Valves—Relief Valves—Grease Traps—Steam Traps and many other Specialties.
Sold by Leading Jobbers in all Principal Cities—Write for Catalog No. 20.

You want a Swing Check that will work under all conditions—

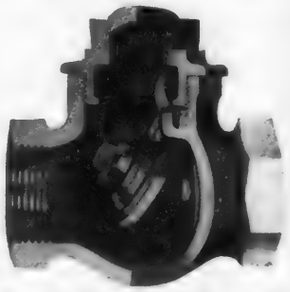
That is to say you need a ROUSE Swing Check Valve. Especially when you want positive action under all changes in pressure, install Rouse Swing Checks with vapor and low pressure heating service, and forget them.

The disc is made to open and close with hair trigger precision, opening instantly and closing wth the slightest reversal of pressure.

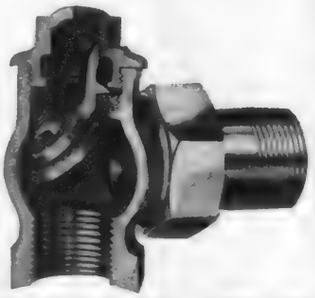
You can use the No. 87 Rouse Swing Check Valve in either horizontal or vertical position.

It is made from the finest bronze, and extra heavy construction assures the maximum strength.

ROUSE CHECKS also made in Iron Body, Bronze mounted, as follows—
No. 88—Screwed Ends—Sizes 2½" to 6"
No. 89—Flanged Ends—Sizes 2½" to 6"



No. 87—Bronze Body Bronze Disc Screwed Ends—Sizes ½" to 3"
No. 87-A—Same as No. 87 but with leather disc



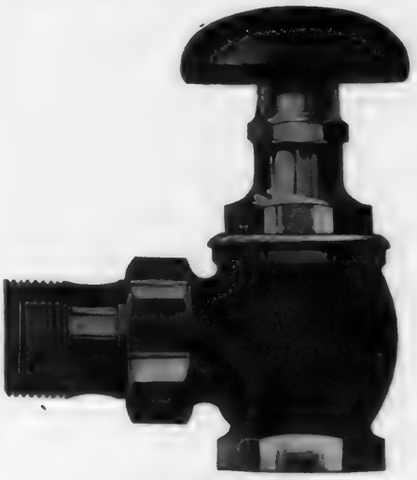
No. 90—Angle Type. Bronze Body with Union-Metal Disc—Sizes ½" to 1¼"

SCOTT SINCE 1886 VALVES
SIGN OF VALUE
"MAXIMUM SERVICE PER DOLLAR"

PALMER HOUSE, CHICAGO

Over 5600

Marsh Packless Radiator Valves installed in this, the Largest, Most Costly to build and Luxurious Hotel in the World.



RE-ENFORCED PACKLESS
FIG. 133

Architects
Holabird & Roche, Chicago
General Contractor
Thompson-Starrett Co., New York
Heating Contractor
Phillips, Getschow Co., Chicago

We specialize on high grade radiator valves, therefore quality, and manufacture the largest line of any company in the business, therefore volume which admits of price, and, quality and price talk.

MARSH VALVE COMPANY

DUNKIRK, NEW YORK

Exclusive Sales Distributors

Appleton & Liptrott, Inc.
1480 Broadway, New York

Edward T. Hetherington,
1718 Sansom St., Philadelphia

United States Radiator Corp'n
General Offices: Detroit, Mich.

All territory east of west lines of Michigan and Ohio and north of Virginia, except New York and Philadelphia.

John W. Mabbs,
431 So. Dearborn St., Chicago, Ill.

Jas. P. Marsh & Company
118 So. Clinton St., Chicago, Ill.

All territory south of Ohio River and west of Michigan and Ohio, except Cook County, "Chicago, Illinois."

Many fine residences are heated with Type "R" Systems, using Webster Boiler Return Trap.

The Webster Type "R" System of Steam Heating

THE Webster Type "R" Modulation System of Steam Heating stands out through a maze of "Vapor," "Return," and similar systems as an approved, reliable, and efficient low pressure system for medium sized buildings.

Type "R" Webster Systems are being installed in buildings with from 500 to 32,000 square feet of radiation. Excellent results are obtained in widely different locations and in various types of buildings. Reports emphasize the fuel economy—ease of operation, and high overload capacity which enables maintenance of temperature during severe cold spells without excessive radiation.

Effective modulation control is procured with Webster Modulation Valves. Complete and silent discharge of air and water from radiators is assured with Webster Sylphon Traps. Air is discharged in the basement through the Webster Vent Trap. Water is returned to the boiler by gravity at negligible boiler pressures. At higher pressures the Webster Boiler Return Trap provides a positive return—automatic, absolutely safe, silent, rapid, and of surprisingly large reserve capacity.

If you are not familiar with the Webster Type "R" System, write for Bulletin 726 and read it carefully before deciding on your next installation.

More than 34,000 Webster Systems Installed Since 1888

WARREN WEBSTER & COMPANY

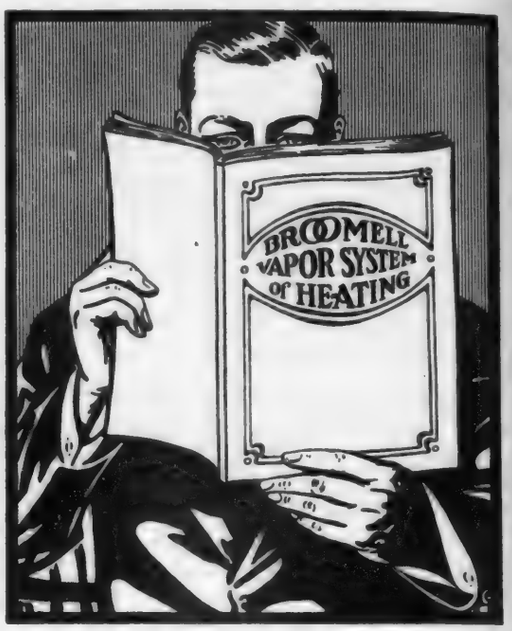
Established 1888

Camden, N. J. : : 46 Branch Offices

In Canada : Darling Bros., Ltd.

Webster

Pioneers of the Vacuum System of Steam Heating



You can get away

from the worries and troubles of the old style systems of heating—hot water and steam. Specify for your clients the modern, commonsense system—

The Broomell System of Vapor Heating

It will give immense satisfaction both to you and the owners.

To you it means a clean, straight job that will come squarely up to the heating specifications and requirements; no alterations or changes to be made; profits you can count on; client more than pleased. And we guarantee the perfect working of our heating system, when installed according to our plans and specifications.

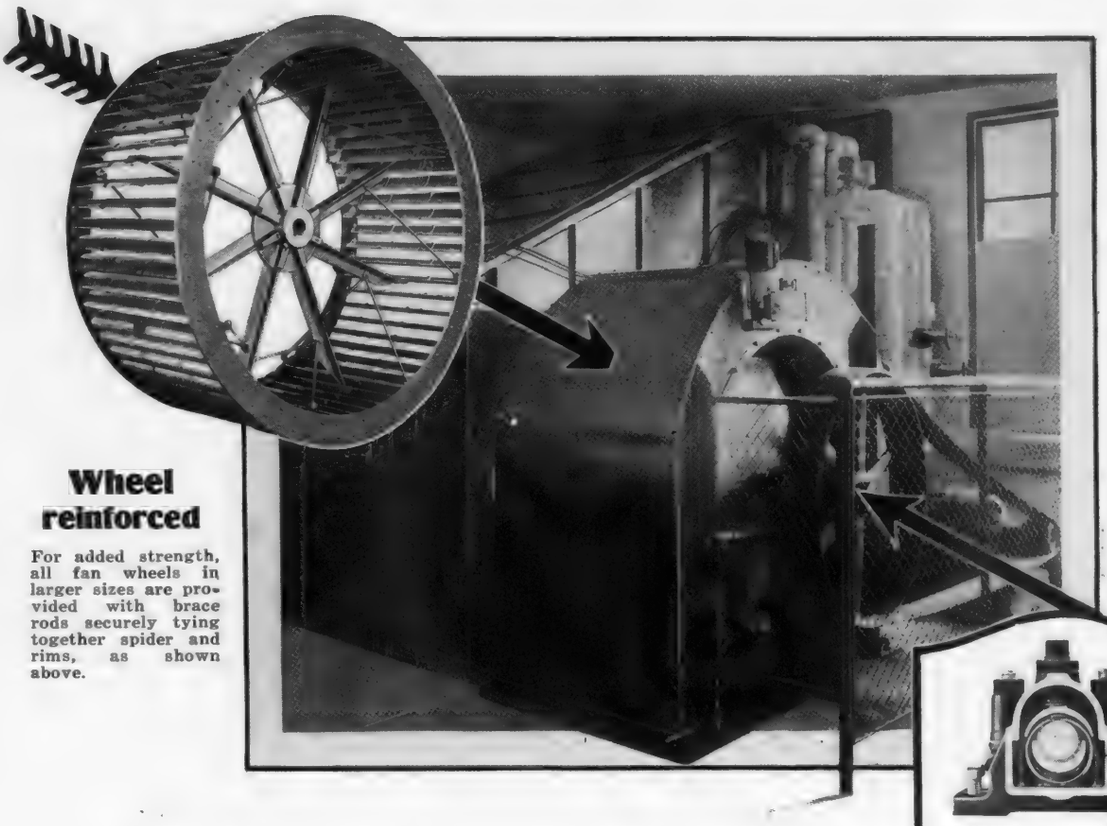
Your client gets a system that's a big fuel economizer—because just the amount of coal needed to produce the desired temperature is used. It's self-regulating in that the draft is regulated automatically as heat is used; noiseless; trouble-free; temperature of each room is easily controlled by the famous Vapor Radiator Valve, on each radiator; no leaks or breaks from water or steam pressure in pipes or radiators.

You will certainly want to know all about this thoroughly modern and efficient system. It's fully explained in "The Vapor Heating Catalogue." Send a postcard now for your copy. We'll send with it complete details of how we work in your interest. This is the most valuable heating data that you could have at hand.

VAPOR HEATING CO.

201 N. George Street, York, Pa.

the Clarage
new type HV
fan is
ruggedly
constructed
as well as
scientifically
designed

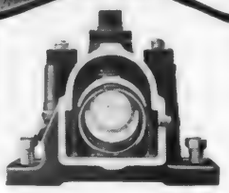


Important

Maximum efficiency of 77% applies to single inlet HV Fan only. Double inlet HV Fan attains maximum efficiency of 81½%.

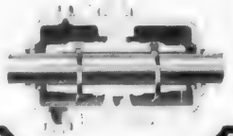
Wheel reinforced

For added strength, all fan wheels in larger sizes are provided with brace rods securely tying together spider and rims, as shown above.



Better Bearings

Large oil capacity with positive lubrication, self-aligning features, and felt washers keeping oil in and dirt out make bearings on HV Fans best obtainable.



Nothing Skimped—sturdiest build makes permanent this Fan's High Efficiency

Stoutest construction is equally as essential as highest performance, if your ventilating fans are to operate with *strict* economy during their entire life of service.

The New Clarage HV Fan is, not only the *most* efficient of its type, but it is one of the best, *most* ruggedly built, as well.

Study the wheel construction and the type of bearings furnished. To these features, add bearing supports running to the floor line in *every* case, and you have the parts of the fan receiving all of the wear and strain *fully* protected.

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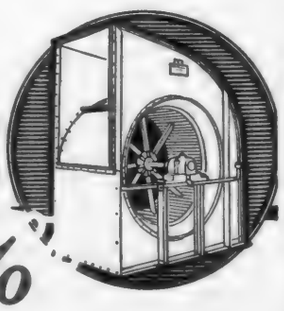
CLARAGE MULTIBLADES

New Type HV maximum efficiency 77%



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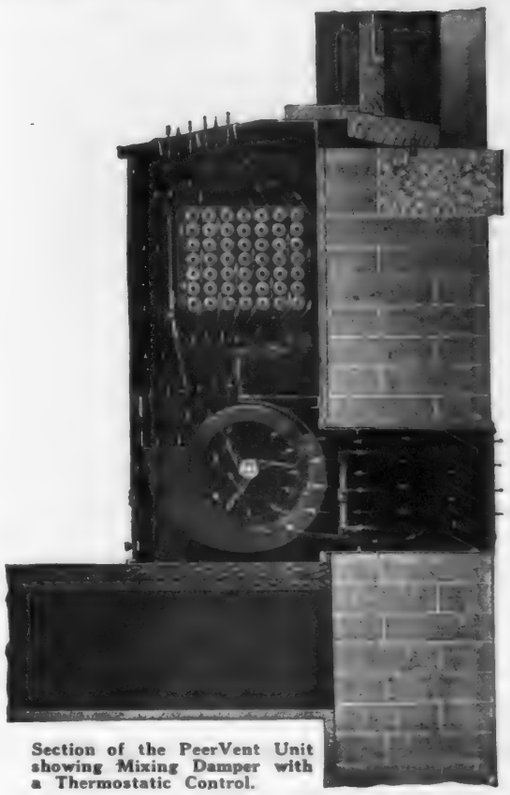

Section of the PeerVent Unit showing Mixing Damper with a Thermostatic Control.

PeerVent Heating and Ventilating Unit.

PeerVent Unit with front removed, showing fans, motor, and mixing damper.

PeerVent Unit with the front and mixing damper removed, showing Peerfin Radiator.

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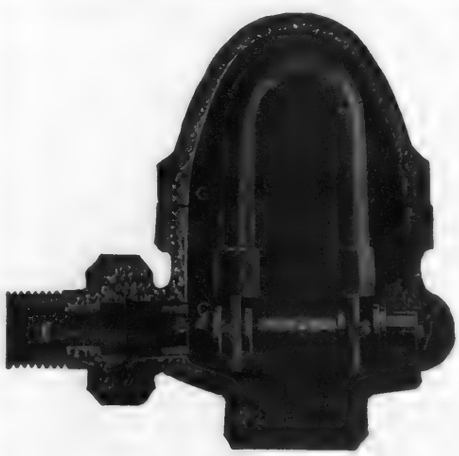

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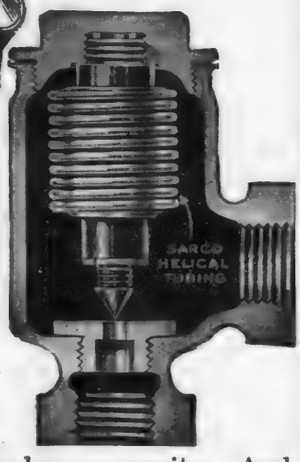

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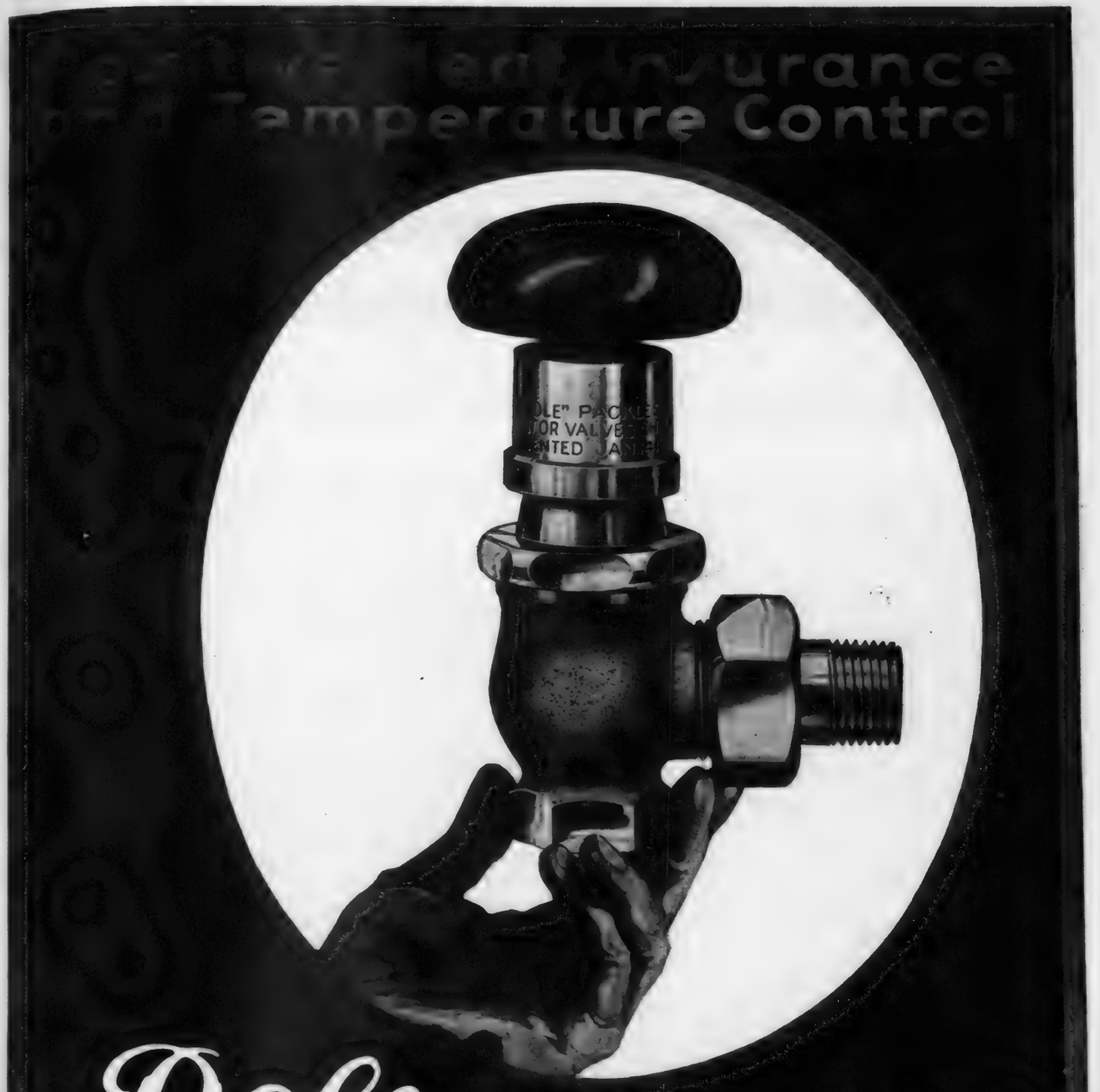

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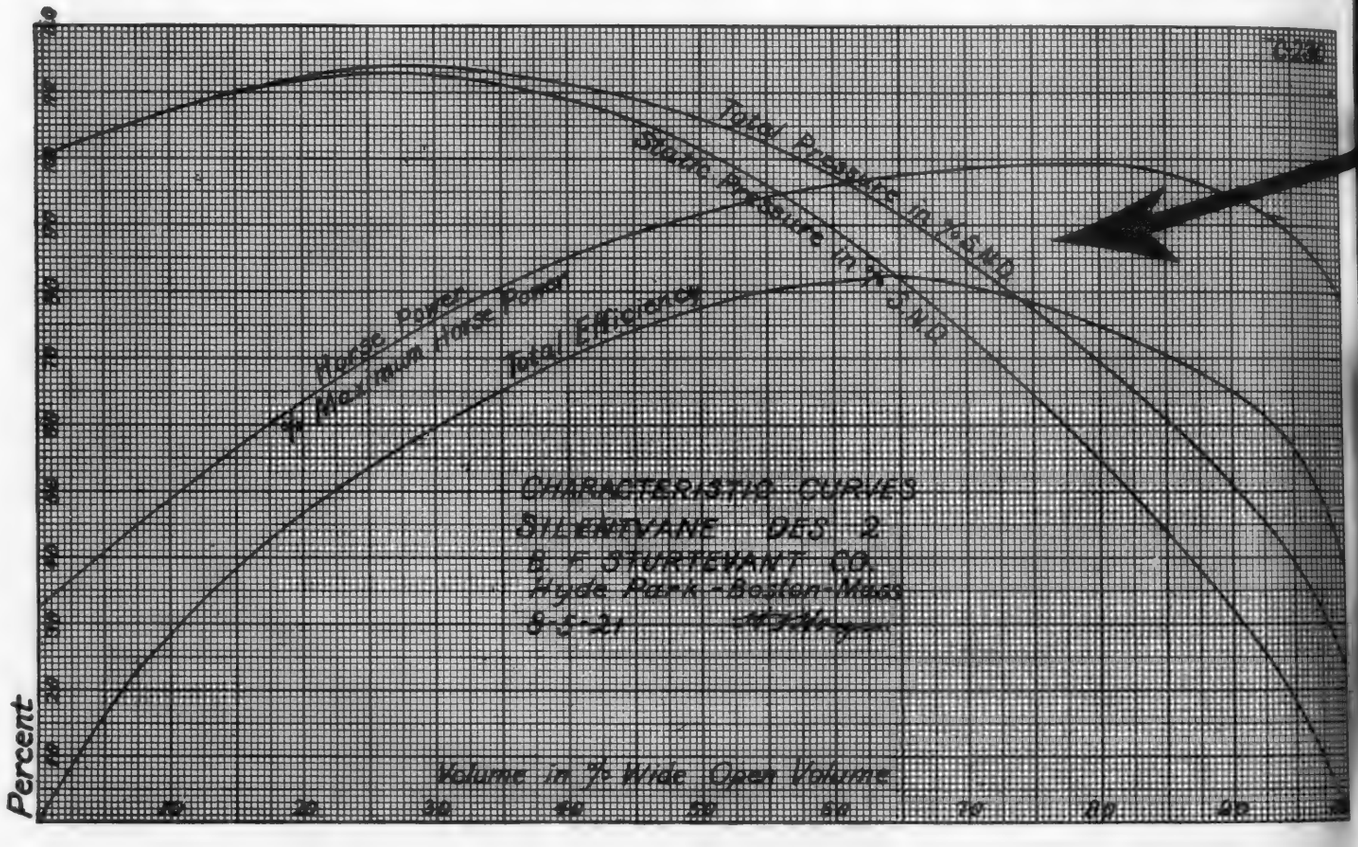

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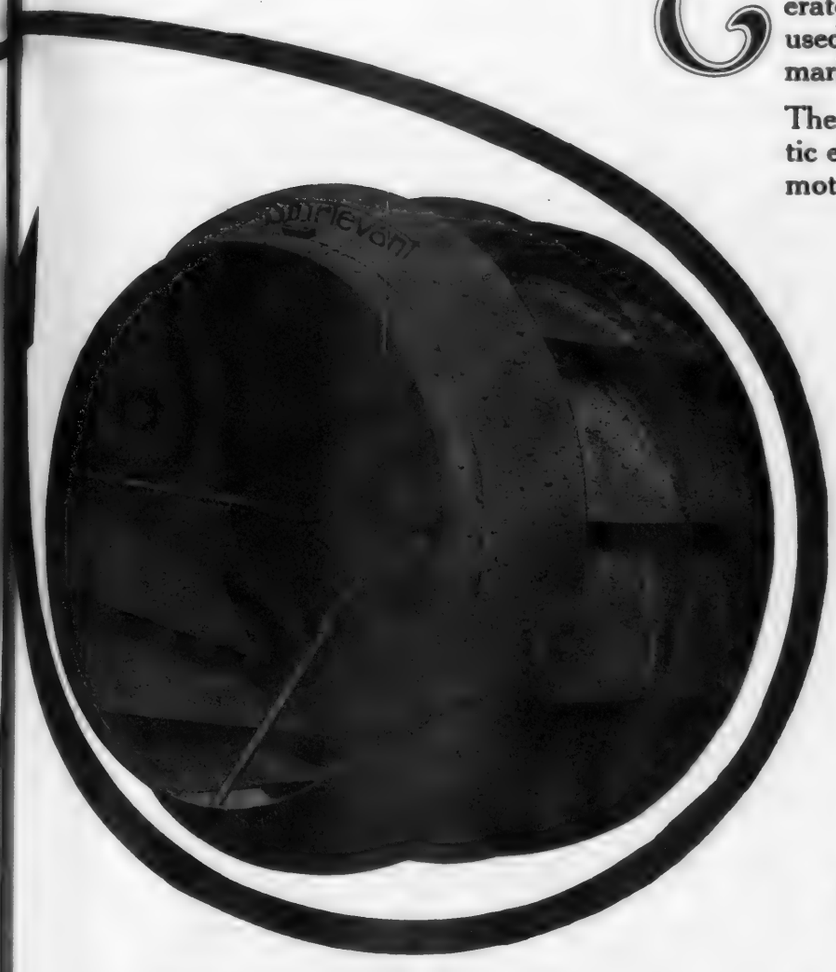
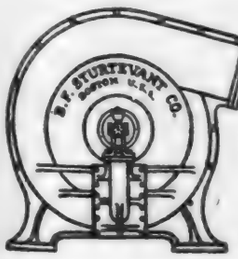


All tests were conducted in accordance with the Standard Test Code adopted by the National Association of Fan Manufacturers and American Society of Heating and Ventilating Engineers.



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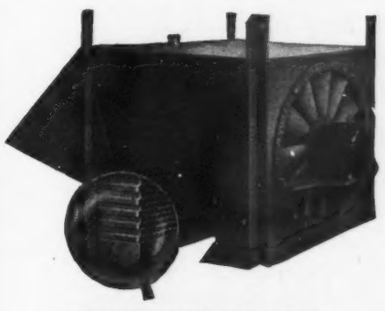

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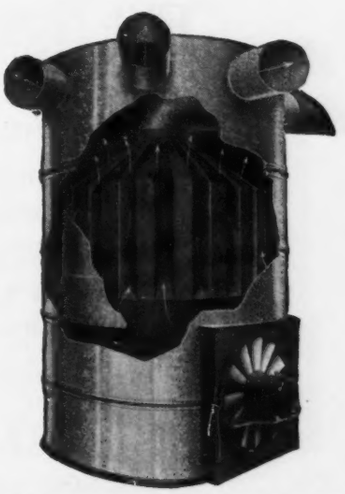

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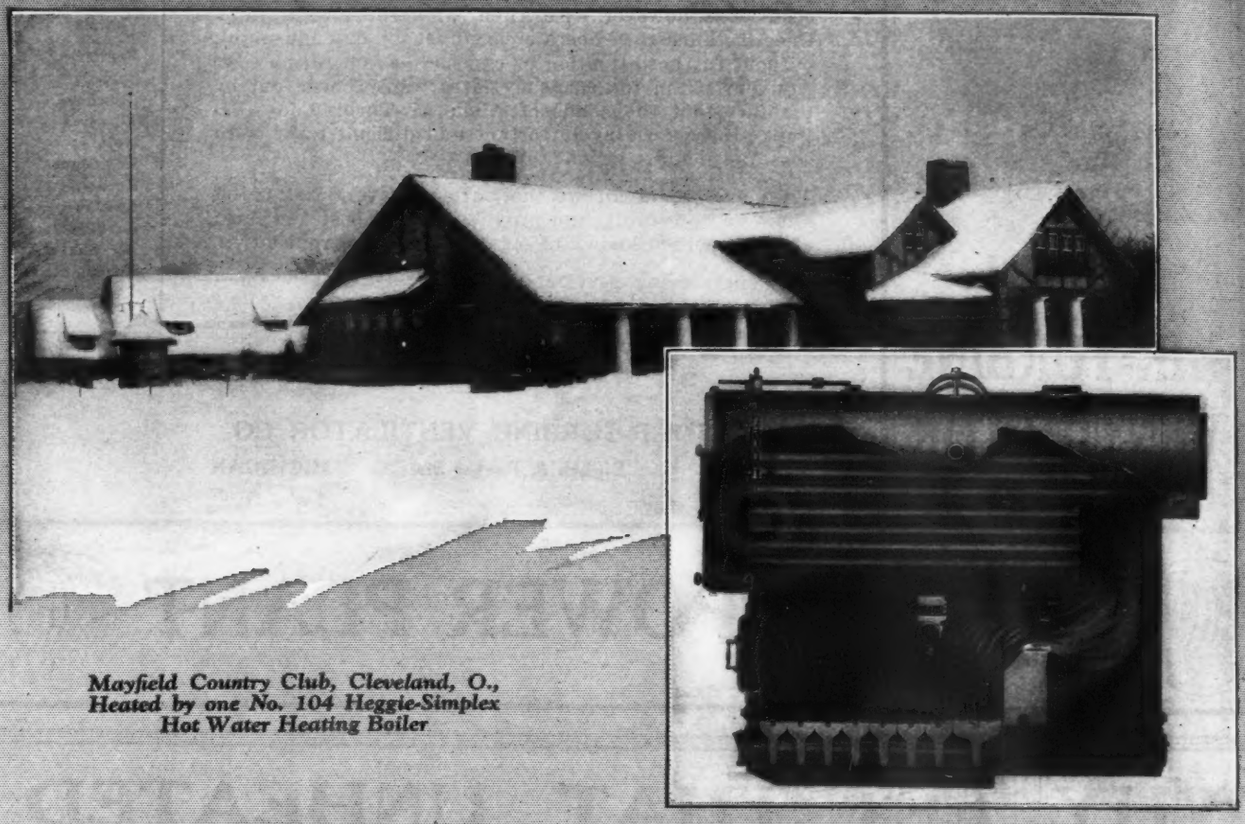

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